SKYSHL

Optical Fiber Fusion Splicer

SS413F Series User's Manual

Shenzhen SKYSHL Technology Co.,LTD.

V2025.01

Please read carefully this manual
before operating this model of the splicer.

Please follow all safety warnings and cautions in this manual.

Warning (Ignoring this warning, Incorrect use of fusion splicer may cause fatal and serious injury):

Warning!

1.The input voltage range of SS413F series fusion splicer is fixed. Do not use the power voltage outside the range specified. Please use correct AC and DC power supply.
2.Avoid the operation which may cause electrical shock, equipment damage, or even fire disaster, personal injury or death. Please use a dedicated three-wire grounded AC power line and AC / DC power adapter.When the adapter input cable is connected to AC220V, 50 / 60HZ power supply, an effectively grounded three-holes socket must be used.
3.Strictly prohibit to handle AC power cable, adapter and fusion splicer with wet hand, or an electrical shock may occur.
4.When the fusion splicer encounters following faults, please unplug immediately the power output cable of the adapter from the fusion splicer power supply input port and shut down the fusion splicer, otherwise, it will cause the fusion splicer unable to be repaired, even cause bodily injury, death and fire.

- ＊ Smoke, smell, sound or abnormal heating up;
- ＊ Liquid, foreign matter go into the machine;
- ＊ Machine damage or falling down.

5. Do not use gas cleanser to clean the fusion splicer, otherwise the arc of the machine electrode during arc will ignite combustibles, cause fires.
6.Do not operate the fusion splicer in flammable liquid or flammable gas environment, Otherwise it will lead to serious consequences of fire, explosion and so on.
7.Never touch the electrode of this model fusion splicer at work, otherwise, the people will suffer a serious arc electric shock and burn. Shut down the fusion splicer and disconnect the power supply before replacing electrode.
8.Meet proper personal protection requirements in operation, in case the fiber debris get into the eyes, mouth, skin or mouth, causing personal injury.

Warning!

9.There are no parts required for maintenance in this model of fusion splicer. Prohibit dismantling the fusion splicer and power module (lithium batteries). Repair in any errors will cause the machine unable repair even causing personal injury.
10.The power module (lithium battery) is strictly limited in this manual. Wrong use will result in battery explosion, fires and personal injury. Please strictly implement "Battery Precautions" in the manual, "Battery Danger Warning" and other related requirements.
11.If the battery charging can not be completed or charge indicator can not be converted within five hours, please stop charging immediately and contact with our customer service center.
12.The fusion splicer battery is a consumable item. There is a safe period of use. Extended use is strictly prohibited(Safe service life means: The charge-discharge in normal use are less than 300 times).

Note (Ignoring this warning and improper use may cause personal injury and material damage):

NOTE!

1.Not to touch the fusion splicer heater and heat-shrink sleeve with splicing process just completed, otherwise burn hazard will occur.
2.In routine maintenance, the ear syringe may be used for blowing off the dust from the surface of the mirror and the objective lens of the fusion splicer. The operator can also use special lens paper to clean. It is recommended in principle not using alcohol to clean the mirror surface. Please strictly implement the relevant requirement of the manual.
3.Do not store the fusion splicer at a high temperature or high humidity environment.

NOTE!

4.In a dusty environment, the fusion splicer shall avoid dust.
5.When the fusion splicer is moved from a cold environment to a high temperature environment, try to have a heating up process to eliminate condensation.
6.In order to maintain fusion splicer performance and stability, the machine maintenance in factory is recommended once a year.
7.The fusion splicers are accurately calibrated, try to avoid intense shock and collision, and use a dedicated carrying case for transportation and storage.
8.The repair and commissioning of the fusion splicer must be performed by professional and technical personnel. Incorrect use methods or undesirable devices can cause bad damage to the equipment. If a problem occurs, please contact in time the manufacturer.

★ **Exemption clauses:**

For alllosses caused by using non-original battery,battery charger, power adapter and so onnot provided by our company,the Company will not accept any liability.

★ **Symbols and logo**

Please give full attention to the safety warning signs used on this model fusion splicer.

High voltage warning signs: **High voltage; no touch.**

High temperature warning signs: **High temperature; no touch.**

1.Overview

Thank you for choosing our products. This user manual describes mainly the detailed operation steps of SS413F automatic, high-performance optical fiber fusion splicers which are the latest products made by our company. The machine adopts a high-speed image processing technology and special precision positioning technology. The whole process of fiber fusion splicing can be completed automatically within 9 seconds. Provided with TFT color 4.3 LCD display, the screen is protected by high strength protective panel. User-friendly graphical interface is convenient for efficient and quick operation by the user. High performance battery can realize online charging continuously in the work, to get a longer battery life. No manual arc calibration operation is needed. The machine has real time splice arc control and correction functions. In extreme environment, the machine can alsoeffectively ensure the splice quality of optical fiber. The machine is featured with fast splice speed, less splice loss, light weight, portable, applicable to backbone network, metropolitan network and FTTH project. In order to complete accurately the splice operation, please read carefully this user's manual.

1.1 Product specifications

Applicable optical fibers	SM (G.652 & G.657), MM (G.651), DS (G.653), NZDS (G.655) and user-defined optical fibers
Splice loss	0.02 dB (SM), 0.01 dB (MM), 0.04 dB (DS/NZDS)
Return loss	Better than 60dB
Control technology	Real time splice arc control and correction; Self adaptive in working environment scope; Electrode oxidation self adaptive.
Splicing time	<9 seconds (standard SM).
Heat time	<25 seconds (The Heat time can be set and the heater temperature can be adjusted.); Fast heat function, functions of automatic or manual heating selection.
Splicing function	Step-by-step splicing or automatic splicing optional
Fiber alignment	Fine alignment, fiber core alignment, cladalignment, manual alignment
Fiber diameter	Cladding diameter 80~150μm,coating diameter 100~1000μm
Cleave length	Coating less than 250μm: 5 ~ 16 mm; Coating 250 ~ 1000μm: 16 mm.
Tension test	Standard 2N (optional)
Fiber clamp	Multifunctional clamp is applicable to bare fiber, tail fiber, jumper, covered fiber and stealth fiber. The clamp meets the requirement of industry standard FTTH fusion quick splicer.

Magnification times	310 times (X-axis or Y-axis);150 times (X-axis and Y-axis).
Heat-shrink sleeve	60mm, 40mm and a series of micro- shrink sleeves (some features are optional)
Display	Provided with TFT color 4.3 LCD display. The screen is protected by high strength protective panel. Contents (image) can be flipped, easy for two-way operation.
External Interface	USB2.0 Interface: convenient data download, USB flash disk upgrade software.
Splicing mode	100 groups user mode, 53 groups factory mode.
Heater mode	40 groups user mode, 11 groups factory mode.
Connection storage	Built-in memory is capable to save latest 10000 splices. Store 100 groups of splice images (X, Y fiber splicing images).
Electrode life	> 3000 times (times of arc).
Built-in battery	Continuous splicing, heating more than 350 times (typical environment).
Power saving function	In "Power Save Mode" Under typical circumstances can save 15% battery power

Power supply	Lithium battery provides 12.5 V power (charging in 10.8V) and can be charged continuously when the splicer works. When the charging time ≤3.5, the battery charging times are not less than 300 times. (Charging) Power adapter: Input AC100-240V 50 / 60HZ, Output DC13.5V / 4.8A. The present power mode can be identified, real-time monitoring the present battery capacity.
Work environment	Operating environment: -10～+50℃; Storage temperature: -40~+ 60℃ ; Humidity:<95% RH (non-condensing); Operating altitude: 0~5000m. Maximum wind speed:15m/s.
External dimension	133(length)*163(width)*140(height)
Weight	1.6Kg(not including battery)

□ SKYSHL splicer, powerful core, service oriented.
□ Battery charging online, lasting longer.
□ Splicing arc real-time control, no manual correction needed.
□ 4.3" color LCD display, high strength panel.

1. 2 Standard configuration of splicer

The following is the standard configuration of splicer:

No.	Name	Thumbnail	Quantity	Remark
1	Fusion splicer		1 set	Host
2	Carrying case		1 piece	Parts
3	Lithium battery		1 piece	Parts
4	Spare electrode		1 pair	Parts
5	Power adapter		1 piece	Parts
6	AC power cable		1 piece	Parts
7	Plastic tweezers		1 piece	Parts
8	Cleaning brush		1 piece	Parts
9	Inspection report	—	1 copy	Accessories
10	Certificate of quality, warranty card	—	1 copy	Accessories
11	Packing List		1 copy	Accessories

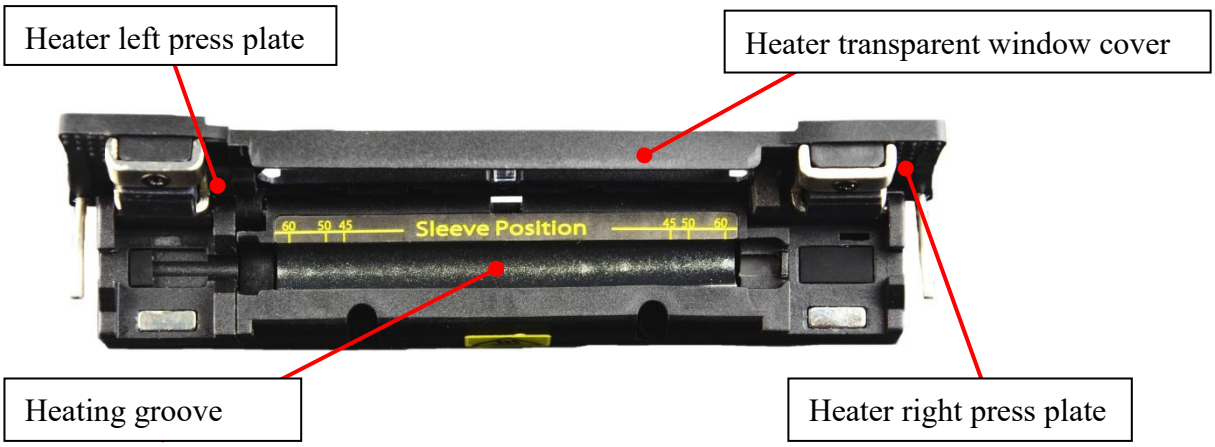
The following is optional parts of splicer.

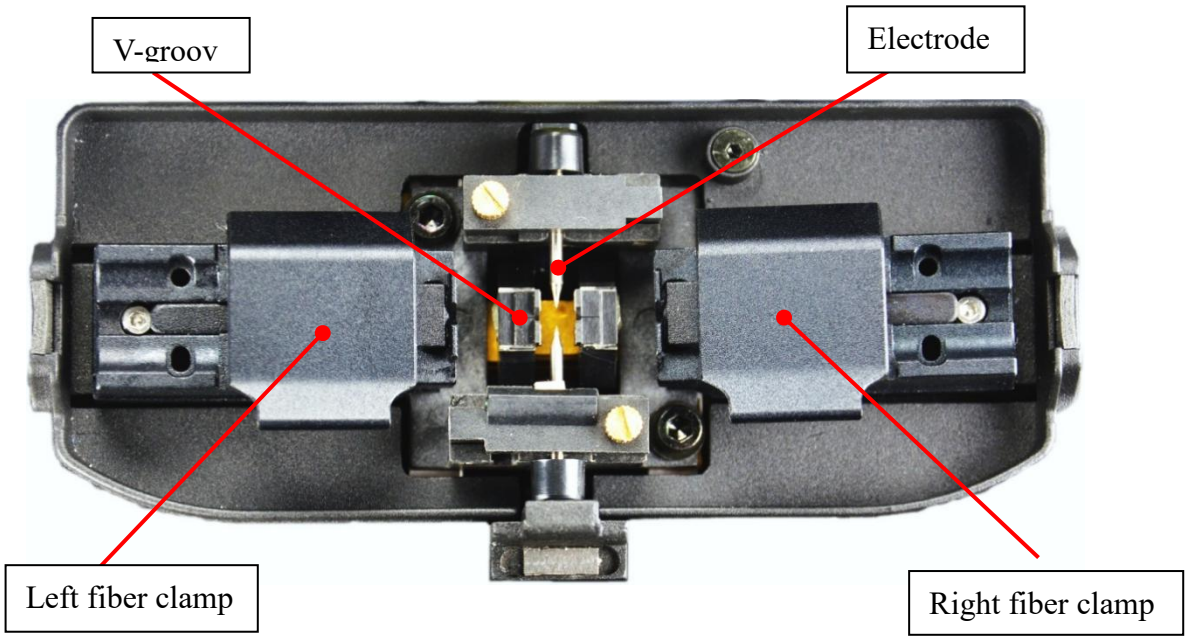
1	Hot joint clamp		1 piece	Optional
2	Heater clamp		1 piece	Optional

Remarks:

1. The standard configuration above is the configuration recommended by our company. The configuration of the machine in packing box is based on the packing documents, i.e. "packing list" in the packing box and is not described in detail.
2. Theoptional parts are not the basic parts of the fusion splicer in the packing box and shall be ordered by the user separately.

1.3 Name of main components of fusion splicer





1.4 Keypad instruction of fusion splicer

Button	Readiness	Manual mode	Automatic mode	Parameters menu
	Power switch	Power switch	Power switch	Power switch
	Moving cursor	Upward movement of fiber	In valid	Increasing the amount of parameters / moving cursor
	Moving cursor	Downward movement of fiber	In valid	Reducing the amount of parameters / moving cursor
	Moving cursor	Leftward movement of fiber	In valid	Reducing the amount of parameters / moving cursor
	Moving cursor	Rightward movement of fiber	In valid	Increasing the amount of parameters / moving cursor
	Entering splicing mode menu	Open manual drive motor function at pause	In valid	Entering lower level menu /operation screen

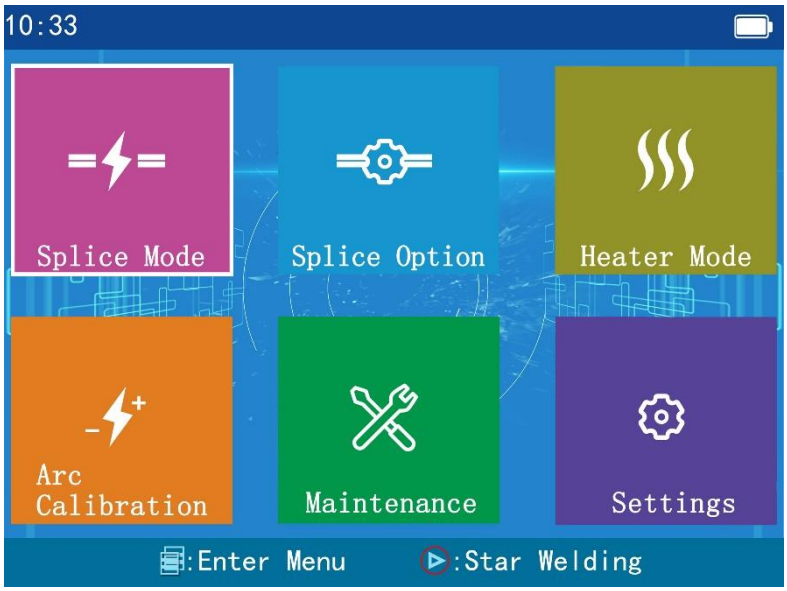
	Start splicing	Continue forward / Start splicing	Start splicing	Confirming Option Function / Parameter modification
	In valid	Motor Reset / Return to readiness screen	Motor Reset / Return to readiness screen	Return to higher level menu / readiness screen
	Heater Switch	Heater switch	Heater Switch	Heater switch
	In valid	Next step /Arc	Repeating arc	In valid
X/Y	In valid	Switching over X / Y display screen	Switching over X / Y display screen	In valid

Remarks:

①. "power switch" button is installed at the lower left side of the machine panel.

②. For the detailed operation of [step by step splicing mode], please read "4.8 Motors operated manually " in this manual.

1. 5 Description of readiness screen of fusion splicer



- Top right corner of the screen  : Indicating the present power supply mode of "power adapter".
- Top right corner of the screen  : Indicating "Heater" is "warming up" at current.
- Bottom of screen 

: Indicating "Keypad operation" on current screen.

LCD display

SS143F series of fusion splicers are equipped with a liquid crystal display. It is a precision device manufactured in factory environment with quality controlled strictly. Nevertheless, there may be also some individual black, red, blue, green dots on the screen. The brightness of the display will be different at different viewing angle to the screen. **These symptoms are not the defects of LCD display, but natural phenomenon.**

2. Basic operation

2.1 Power supply of fusion splicer

The power supply modes of SS413F optical fiber fusion splicer are divided into "external power adapter" or "removable lithium battery". Built-in high-performance battery panels can be charged online continuously in the work in lithium battery power mode to get a longer battery life. To correctly and safely use this type of fiber splicer, the operator shall use the built-in high-performance battery and parts (power adapter and lithium battery)provided by our companyand read carefully the operation description in detail.

2.1.1Po

wer supply by power adapter

<1>The basic parameters of the exclusive AC/DC power adapter of the fusion splicer produced by our company :

INPUT: AC100-240V ~ 1.8A 50 / 60HZ OUTPUT: DC13.5V / 4.8A

- **Use only AC adapter power cable supplied with the machine.**
- **The ground terminal of AC input power cable must be effectively grounded.**

- **When using AC generator, the operator shall check regularly whether it conforms to AC input requirements of the output voltage.**
- **Use only DC output power cable supplied with the adapter.**
- **Strictly prohibit to handle AC power cable, adapter and fusion splicerwith wet hand,or an electrical shock may be caused.**

<2>Power supply of the power adapter is shown as follows:No power connector is required at the bottom of the splicer. The power adapter is connected to AC mains power.Finally, DC output power cable is connected to "DC IN" inlet of the power supply at the right side of the fusion splicer. The fusion splicer is powered then by the power adapter.

<3>When the fusion splicer is powered by the power adapter, the indicator flashes at "DC IN" input at the right side of the splicer as shown in following drawing.

- If AC voltage of the mains power (or generator) is lower than 100V or higher than 240V or unstable, AC / DC power adapter will not provide normal DC output. DC output cable of the power adapter can not be connected to "DC IN" input of the fusion splicer.

⚠o not use external power supply which does not meet the requirements of our company,otherwise it will burnout fusion splicer or cause personal injury. When the AC/DC power supply adapter input cable is connected to AC220V, 50 / 60HZ power supply, the user must use an effectively grounded three-holes socket.

2.1.2 Power supply by lithium battery

The lithium battery in this machine is an "independent removable battery":If the fusion splicer will not be used for a long time, the battery must be removed from the splicer for safety concern. When the splicer is going to be used again, the battery can be installed to the splicer quickly, realizing "charging battery while working". The battery can always be charged directly on-line and the service life of the battery can be prolonged thereby.

A.Lithium battery installation and power supply

As shown in the figure below, hold the splicer with and with the bottom facing upward, "independent removable battery" is installed at the bottom of the splicer. As indicated by the arrow, the splicer is powered by the "independent

removable battery".

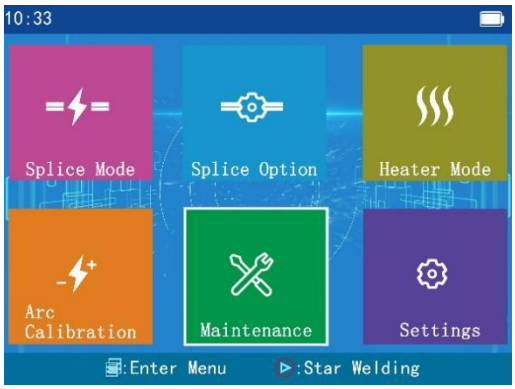
B.Lithium battery capacity check

After "independent removable battery" is installed in accordance with the steps above, the check operation is as follows.

<1>Move the cursor to [Maintenance] screen on the readiness screen and press  button to enter.

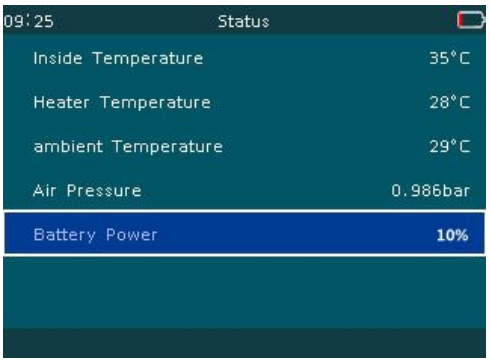
<2>In [Maintenance] screen, press  button to select "Status".

<3>Press  button and [status] screen appears. "Battery capacity is 90%" is the capacity of the battery at present.



C.Charging lithium battery

When "battery capacity <20%" on [status] screen, top right corner of the screen displays "battery under voltage";or"undervoltage" alarm is on during the work of the fusion splicer.The lithium battery shall be recharged in time. When "Battery capacity ＜10％", the splicer will beep for about 30 seconds and shut down automatically .



<1>The power adapter is connected to AC mains power. As shown in the figure below, DC output power cable is connected to "DC IN" inlet at the right side of the fusion splicer. The power adapter is charging the lithium battery, realizing the lithium battery online charging function. The lithium battery "provides power and is being charged".

<2>When the lithium battery is charged by the power adapter, the "red" indicator at "DC IN" input at the right side of the splicer is on as shown in following drawing, i.e. The lithium battery is charged by one time.

- Always use our designated AC / DC power adapter for battery charging.
- Long-term power shortage of the lithium battery will damage the lithium battery.

<3>When the lithium battery is being charged, the charging indicator is in red. When charging is completed, the indicator is off.

<4>The longest charging time is 3 hours and 30 minutes and the remaining battery capacity determines the length of charging time.

2.2 Battery application precautions:

<1>The battery shall be used in a normal environment. The nvironmental requirements on battery charging, discharging and storage are strict:

Battery charging temperature: 0℃ ~ 40℃;

Operating ambient temperature: - 35℃ ~ 60℃;

Storage ambient temperature: -5℃ ~ + 35℃;

Relative humidity: 65 ± 20% RH.

<2>The battery shall keep away from heat, moisture, high pressure and high electrostatic environment and so on during use, as well as collision and knocking.

<3>Battery charging is a complex chemical reaction process and the proper charger shall be used only for safety. The attendant must be at site during battery

charging. More than five hours charging is prohibited.

<4>If the fusion splicer will not be used for a long-term, the battery must be removed from the splicer for safety concern. The battery should have half capacity in storage condition and shall be charged once in every 2 to 3 months.

<5>The voltage and appearance of the battery should be checked once every 2 to 3 months and the battery shall have a thorough charge and discharge once in every 6 months.

<6>For the battery with the time leaving the factory within one year, in case the charging and discharging time is significantly shorter (only half the time of normal use and shorter) or when there is obvious bulging, do not use the battery at once and return it to the factory for inspection and maintenance.

<7>The fusion splicer battery is a consumable item and has a safe service life. Extended use after safe service life is strictly prohibited. Safe service life means: The charge-discharge in normal use are less than 300 times.

2.3  Battery hazard warning:

<1>It is strictly prohibited to dismantle the battery:

The battery inside is fitted with protective circuit, which can guarantee the battery safety when used under normal environment. Improper disassembly will damage the protective function of the battery, could cause short circuit in the battery core and cause the instantaneous heat, combustion, and other dangerous of the battery.

<2>Battery short circuit is strictly prohibited.

In any case, do not short-circuit the positive and negative terminals of the battery, otherwise, once the battery core protection circuit fails, there will be a large current, causing the battery heating up, smoking, firing and other hazards.

<3>Never heat up or incinerate battery.

Heating or incinerating battery will cause melting of the core spacer, burning of electrolyte, and the risk of fire or explosion.

<4>Avoid sunlight exposure or rain water

Sunlight exposure may cause the battery to generate high temperature and rain water may cause battery short circuit and other fault and cause easily the fail of the protection functions.

<5>No battery shall be submerged in water.

Battery packing is not waterproof. The battery submerged in water will make the battery cells have abnormal chemical reaction, smoke, fire and other hazards.

<6>The dedicated charger shall be used and the battery shall be properly charged.

Battery charging process is a special process of electric ions reactions. The performance requirements of battery cell in charging are fully taken into account in the design of the dedicated battery charger. The multiple protecting functions can prevent the risk of heating up, burning and so on of the battery in charging process. The battery shall be charged in accordance with the correct way and charging for too long time could pose a safety risk.

<7>Do not contact directly with battery leak electrolyte.

The leaking electrolyte has certain corrosion. Once leakage occurs, do not touch it directly with hand. If the battery fluid gets into your eyes, rinse immediately the eyes with clean water. Do not rub the eyes. Go quickly to the hospital for treatment. When the electrolyte leakage is found, take out the battery quickly from the machine, so as to eliminate safety risks and avoid also the machine corrosion.

<8>The battery should be placed away from children.

The identification and control ability of the child is poor. The battery should be placed outside the child's reach to avoid accidents.

2.4 Power-saving mode operation

To save unnecessary consumption of battery power, the fusion splicer can be set to enter the power saving mode or shutdown mode when the fusion splicer is not operated within a certain period of time. See [Settings] power save menu (Section 3.7).

2.5 Under voltage alarm (battery-powered)

This model fusion splicer has "low voltage alarm" function. When the lithium battery (group) power is below a certain value (this value is set at the factory and is about 10.3V), the fusion splicer screen will show "low battery!!!" warning window as shown below. Top right corner of the screen has battery under voltage icon and buzzer alarms automatically. At this point, the user should promptly use the power adapter or charge the lithium

battery, or hold down button to turn off the fusion splicer. Otherwise, it will shut down automatically after about 30 seconds.

Remarks: Top right corner of screen : (Simultaneously) displaying the battery under voltage alarm.

2.6 Startup and shutdown

Starting up:

Hold down button. When the LED indicator on the keypad is changed to green, release button. After all motors are back to the initial position, the fusion splicer shows "readiness" screen. The starting up operation is complete.

Shutdown:

Hold down button. After the LED indicator on the keypad is changed from green to red, release button. The splicer completes the normal soft shutdown.

2.7 Display brightness adjustment

On the one hand, the display brightness determines power consumption, on the other

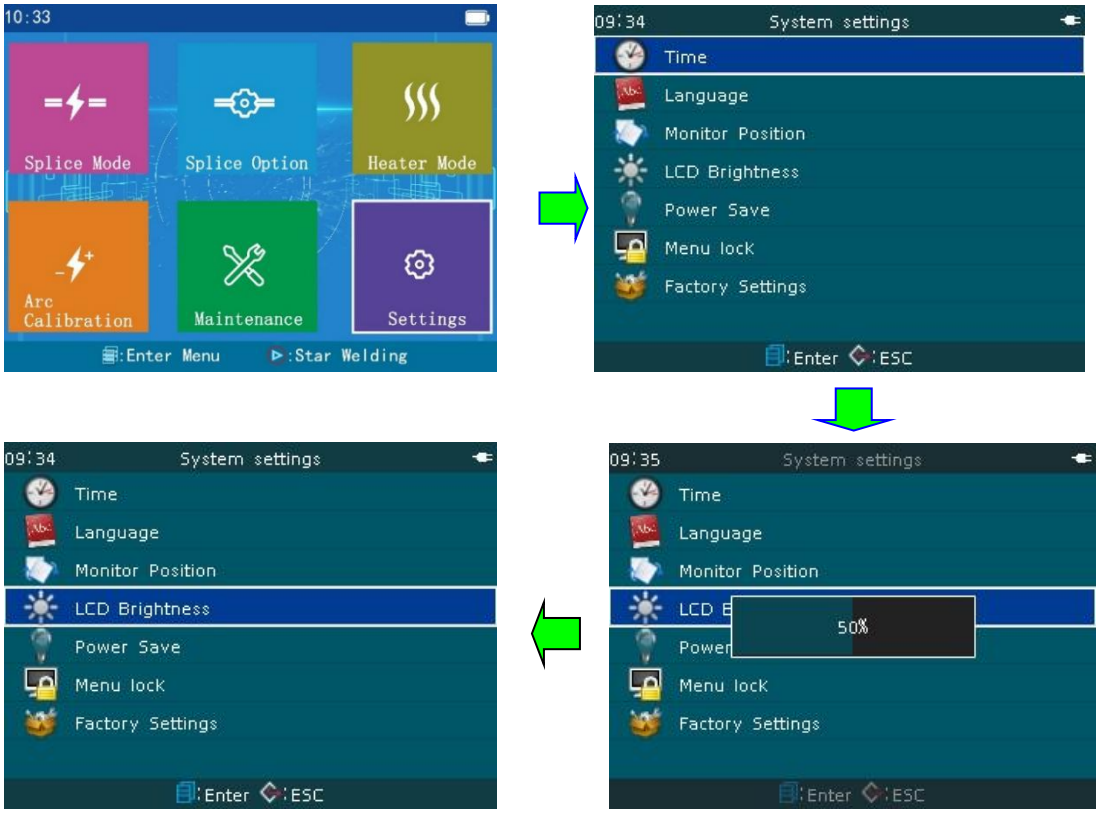
hand, when the external lighting of the work environment is not the same, in order to facilitate the operation of the fusion splicer, the operator can adjust the display brightness. The adjustment steps are as follows:

<1>Move the cursor to [Settings] window of the fusion splicer,press button to enter the settings.

<2>In the "Settings" screen, press button to select "display brightness".

<3>Press button to leave the brightness percentage amplitude value window. Select or button to select the appropriate brightness value. The modified value is valid by the machine in default.

<4>Continue to press button to return to readiness operation screen.

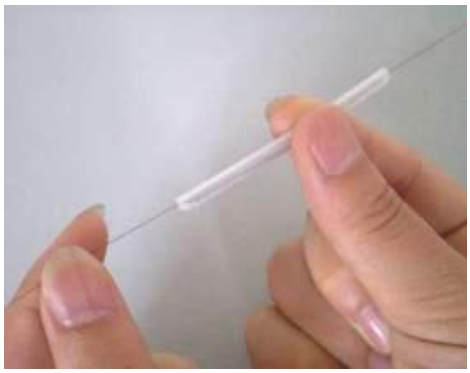


- Display brightness is set to be moderate and not too high so as to reduce power consumption and extend the duration of lithium batteries.

2.8 Preparation of optical fiber end face

2.8.1 Installing optical fiber shrink sleeve

Before the fiber is not spliced, suit a fiber heat shrink sleeve on one fiber in advance as shown in the figure below.



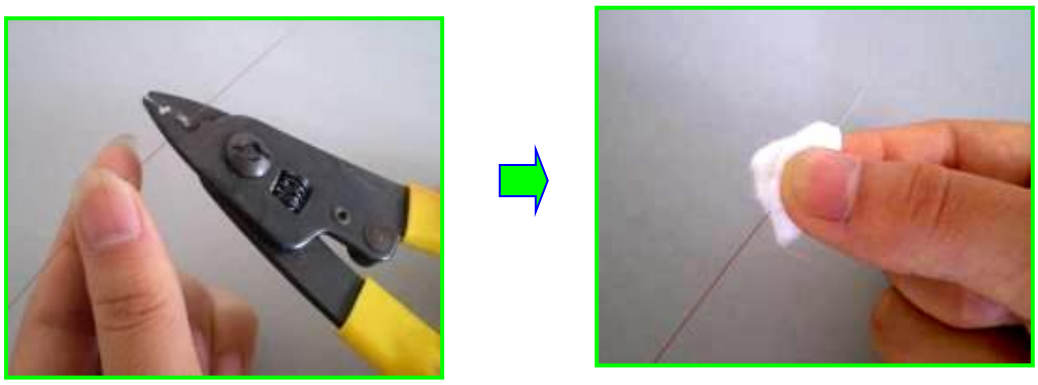
2.8.2 Production of single-mode and multimode fiber splicing end face

A. Open the big press plate of the cutter. Push the sliding block of the blade from the rear end to the front end.

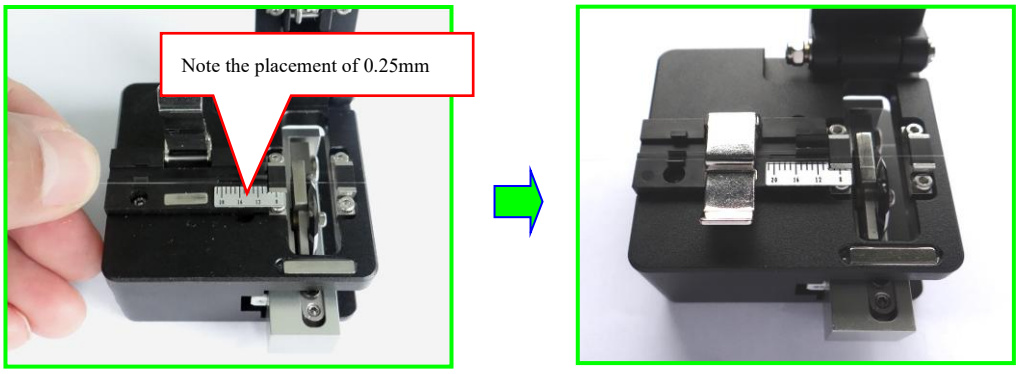
B. Strip off the fiber coating with fiber stripping pliers. The bare fiber length reserved is 30-40mm. Wrap the fiber with absorbent cotton or cotton paper dipped in alcohol. Then clean the bare fiber. Clean the fiber with absorbent

cotton or cotton paper only once. Do not use same absorbent cotton or cotton paper to wipe the fiber for the second time.

(Note: Please use alcohol with purity higher than 99%).



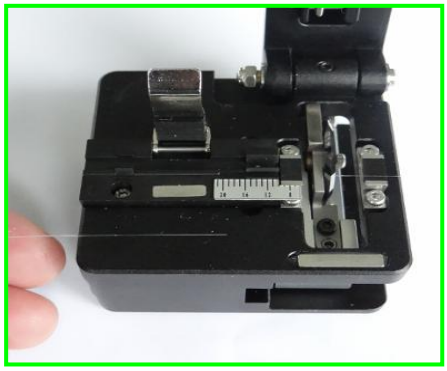
C.Open the smaller steel plate at the left side of the cutter and put horizontally the stripped and cleaned fiber in the guide groove of the cutter. Hold down the smaller steel plate with left hand and close the bigger press plate of the cutter with right hand. It is required that the bare fiber is put straightly on the left and right fiber rubber pressing seats.



D. Hold the cutter with left hand. Then push the sliding block of the cutter blade to the other end with the right hand to cut the fiber.

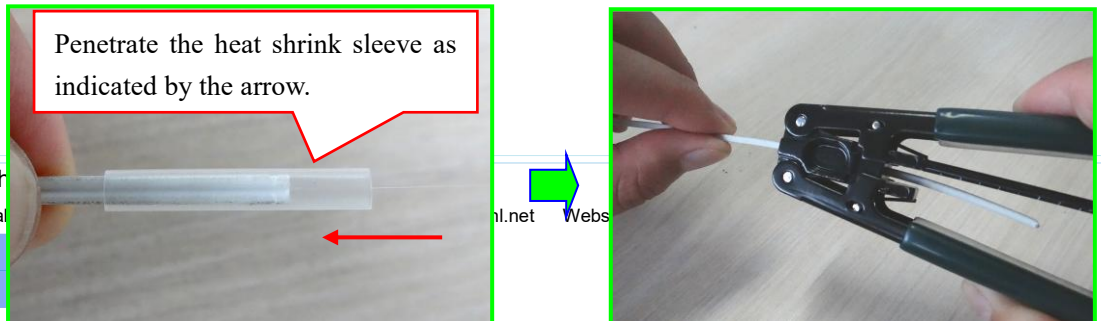
E. Hold the cutter with the left hand. Open the bigger press plate of the cutter with the right hand and remove the waste fiber. Put the waste fiber into a fixed container.

F. Open the smaller steel plate of the cutter with the right hand and hold the fiber with the left hand at same time. Remove carefully the fiber with chopped neat end face. Notice: Neat end face of the fiber shall not touch any item. Put the fiber on the left or right clamp of the fusion splicer.

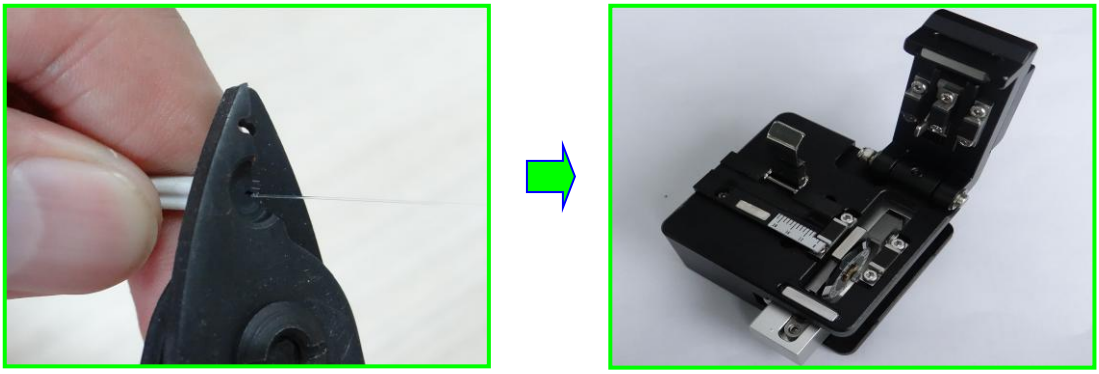


2.8.3 Production of the fusion splicing end face of covered optical cable

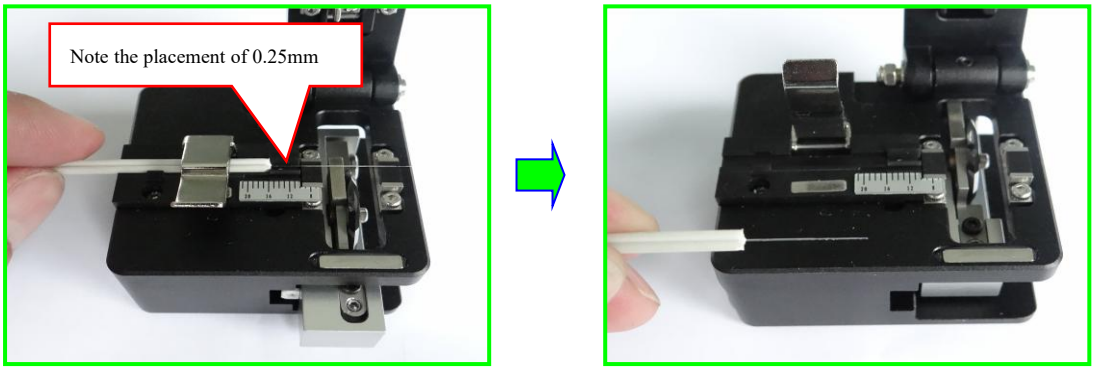
A.Put in advance a heat-shrink sleeve on the covered fiber cable before peeling the cover. Put about 50mm of the covered fiber cable into the stripper for peeling the cover.



B.Reserve 3-4mm coating and peel other fiber coating. Wipe clean the peeled fiber cable with alcoholic dust-free paper.



C.Open the smaller steel plate and larger press plate at the left side of the cutter. Put the stripped and clean fiber cable into the guide groove of the cutter and cut the fiber cable. Put the fiber on the left or right clamp of the fusion splicer.

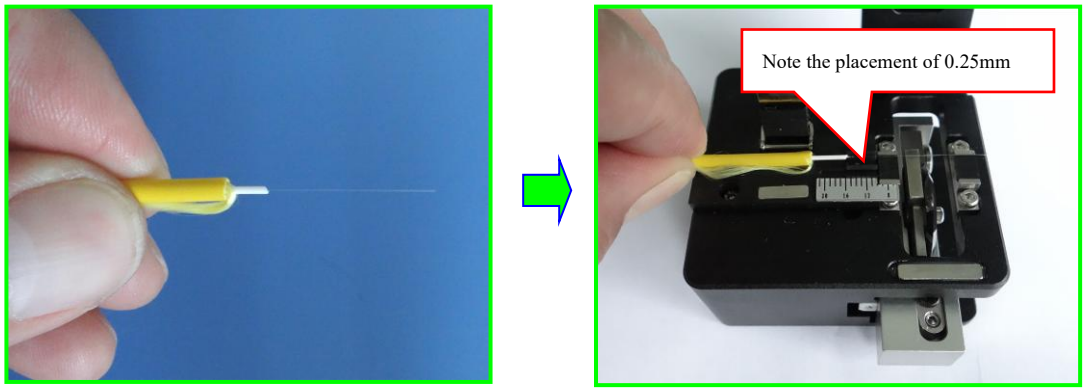


- **When the covered fiber cable is connected with a covered fiber cable, one of the covered fibers shall be installed with a heat shrink sleeve before stripping the clad.**

2.8.4 Production of end face of tail optical fiber

Follow the procedures above. Remove the outer cladding, tight cladding and

coating layer of the tail fiber and wipe clean the fiber with alcoholic dust-free paper. Notice: Reserve 0.9mm cladding for 3 ~ 4mm, 0.25 mm cladding for 3 ~ 4 mm also. Put the tail fiber into the cutter and cut it.



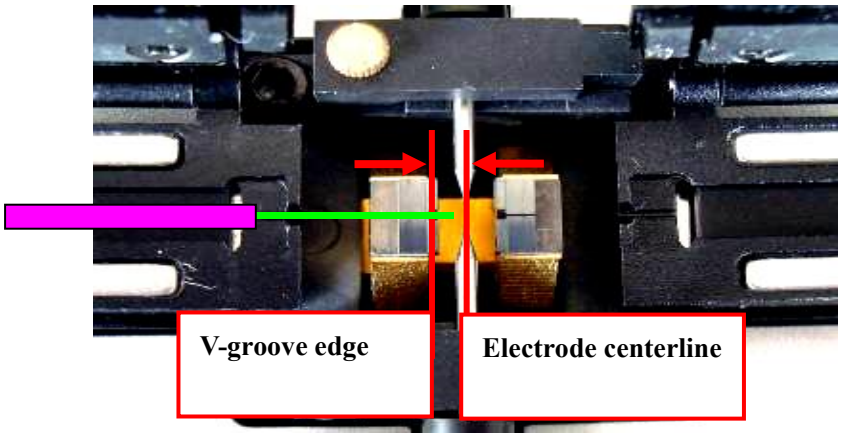
2.9 Placement of optical fiber

A.Open the wind cover and wait for the automatic reset of the fusion splicer until the machine is at readiness status.

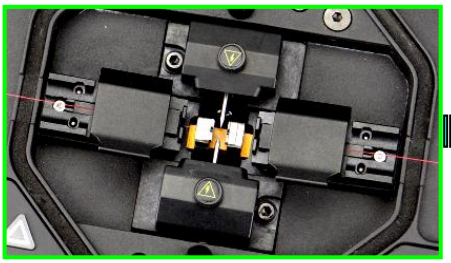
B.Put respectively the prepared fibers into the left and right clamps of the fusion splicer.

C.Make ensure the optical fibers are placed at the bottom of the left and right V grooves.

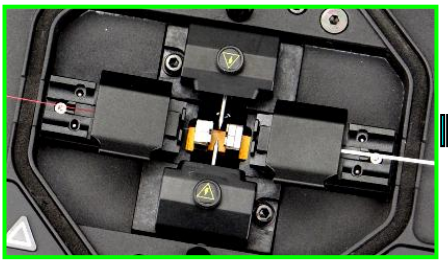
D.The end face of each fiber shall be placed between V-groove edge and the electrode rod centerline.



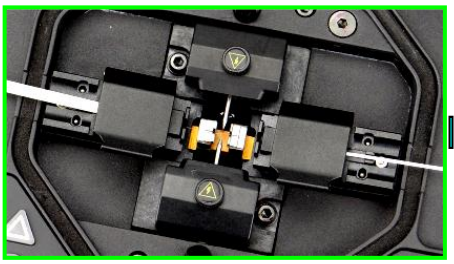
- **The following is the application of different types of fibers in FTTH projects:**



250 μm bare fiber is connected with 250 μm bare fiber.

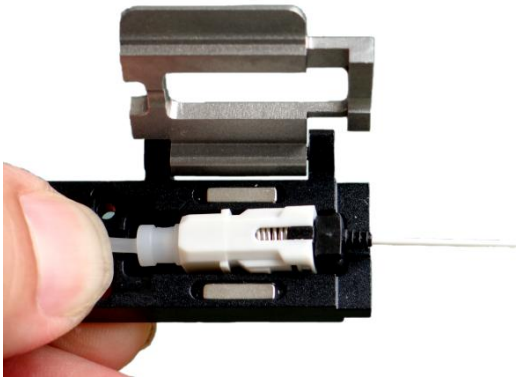


250 μm bare fiber is connected with 900 μm tail optical fiber.



Covered fiber is connected with 900μm tail optical cable.

- **Clamp shall meet industry standard FTTH heat melt fusion quick connector.**



3.Management menu

This chapter details the management of the operation menu of SS413F optical fiber

fusion splicer.

3.1 Overview of first-level menu

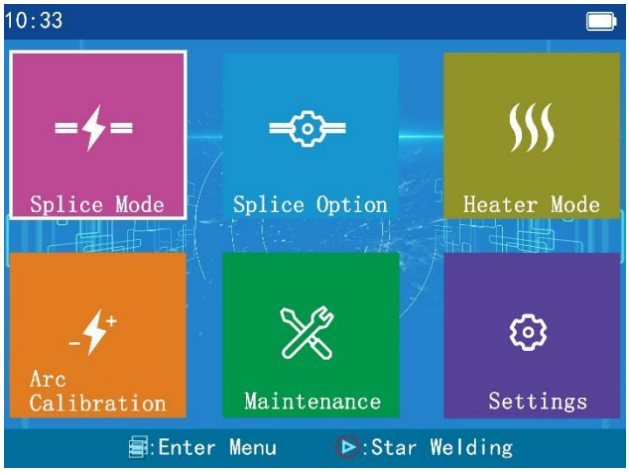
3.1.1 There is one first-level main menu in the operation screen of the fusion splicer, There are six operation windows (second level menu) under the first-level main menu.

3.1.2 On the current main menu window, press  button to execute the default splicing parameter files (factory setting, user mode) for fiber splicing. Press  button to execute the default splicing parameter files (factory setting, user mode) for heater operation.

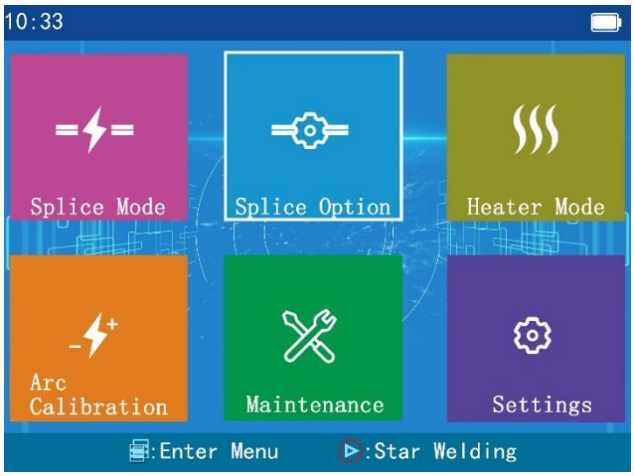
3.1.3 On the current main menu window, press  button or  button, press  button or  button for switching over six operating windows in the first-level main menu window. Press  button to enter the current operation window for operation. The options included in each operating window and the next level menu will be described in section 3.2-3.7 of this manual.

The first-level main menu and six operating windows (second-level menu) are respectively:

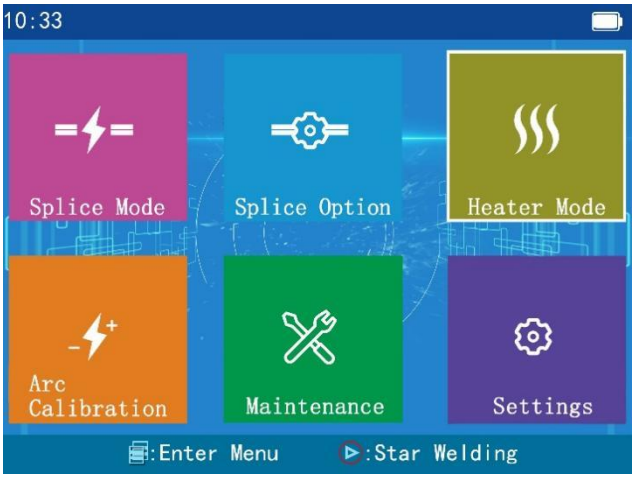
A."Splice mode"



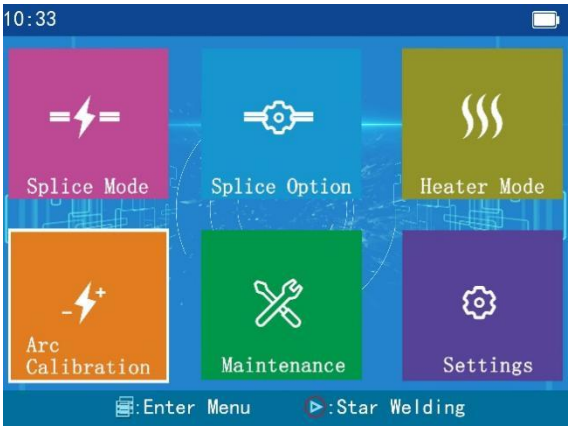
B."Splice options"



C."Heater mode"



D."Calibration"



E."**Maintenance**"

F."**Settings**"

3.2 [Splice mode] operation

3.2.1Overview

A.[Splice mode] has 100 built-in users splice modes (splicing parameter files). Different types of fibers are available for users. Four kinds of the default modes included in the machine are as follows:Auto, Calibrate, Normal, Special. Each set of fiber splicing parameter files include the options, important parameters and so on in process of fiber splicing.

B.[Splice mode] has also 53 built-in factory modes (library) or 53 sets of splicing parameter files for special purpose for users (The splice parameter files in the factory mode "Library" shall be introduced into 100 groups of users splice modes).

C.Description of menu of "select splice parameter files"

In different "Mode" settings (including: Auto, Calibrate, Normal, Special), the users can open the splice parameter files with two permissions. Press  or  button to switchover different windows. Press  button in turn to return back to the original operation window.

D.Description of some modes:

Splice mode	Description of function
Auto	In the process of splicing, the splice arc intensity is adjusted and controlled automatically (only for the splice mode selected).
Calibrate	In the process of splicing, the splice arc intensity is adjusted and controlled automatically. The splice arc intensity is calibrated automatically. "Calibrate - SM": The arc intensity calibrated is effective in all modes; The arc intensity of all modes is calibrated. "Calibrate - MM": The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - MM" mode. "Calibrate-DS":The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - DS" mode. "Calibrate-NZ":The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - NZ" mode.

Normal	Same type of fibers are spliced with the default factory optimized parameters.
Special	Different types of fibers are spliced with the default factory optimized parameters.
Other modes	In the splicer database, there are other splice modes different to the modes listed above. The new splice modes are constantly increasing. The users can contact their sales dealer and ask for the latest splice modes.

SS413F optical fiber splicer in "Auto" and "Calibrate" splice modes is adaptive in work environment and electrode oxidation in all scopes of the work environment (including the combination of extreme working conditions). The splice arc can be real-time controlled and corrected. Therefore, "shrinkage arc correction" function is stopped in the default factory setting. Under normal circumstances, the fiber can be directly spliced. In the following cases, "preheat splicing" is required. After the machine performance is up to the best state, the fiber is spliced then:

A.Environment changes, especially high altitude (atmospheric pressure) changes.

B. Replacement of electrode.

C. Normal or Special mode.

D.Not used for a long-term.

"Preheat splicing": Select "Calibrate - SM" splicing mode; SM fiber splicing is repeated for 1 to 3 times.

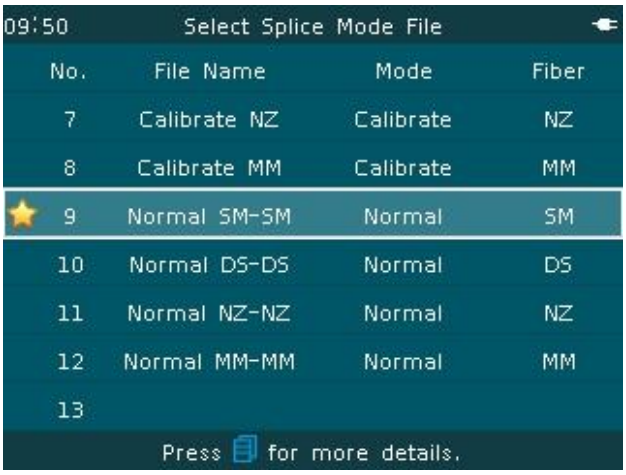
★Warning

"Auto - XX "and "Calibrate - XX" have different range of arc intensity calibration. Therefore, the fibers in "Auto - XX" and "Calibrate - XX" and the fiber to be spliced must be same, otherwise, wrong calibration will occur. If more seriously, the splicing will not be conducted. After the error occurs, under the condition the splicing is possible, the operator can choose correct fiber for "preheat splicing" so as to correct mistakes.

Description of "Auto, Calibrate" splice parameter files

Parameter	Explanation
File (name)	Splice parameter file name is up to 16 characters for users.
Splicing mode	There are 4 splice modes: Auto (automatic), Calibrate (calibration). Normal (General), Special (Special). The last is a special operation option.
Fiber Type	Splice modes corresponding to different fibers have been stored in the database. The operator can choose the appropriate splice mode in the database according to different fiber types and copy it to the user splice modes.

Alignment	Setting fiber alignment method. "Precise":The fiber is aligned according to the the fiber core position and the cladding position at the same time. "Fiber core": The fiber is aligned according the the fiber core position. "Cladding": The fiber is aligned according the the cladding position.
Tension test	If "tension test" is set to "open", after the splicing is completed, the tensile test is performed automatically.
Cleave angle limit	Setting Cleave angle limit. When the Cleave angle of any of the fibers exceeds the limit, a limit alarm message appears on the screen.
Loss limit	When the estimated splice loss exceeds the setting splice loss limit, a limit alarm message appears on the screen.
Time for cleaning discharge	Cleaning discharge is a short duration arc and used to remove tiny dust on the surface of the fiber. Changing this parameter can change the length of the cleaning discharge time.
Manually adjusting arc time	Under certain conditions, the splice loss can be improved by more than one time of arc. Changing this parameter can change the length of the arc time.



Description of "Normal, Special" splice parameter files

Parameter	Explanation
File (name)	Splice parameter file name is up to 16 characters for users.
Splicing mode	There are 4 splice modes: Auto (automatic), Calibrate (calibration), Normal (General), Special (Special). The last is a special operation option.
Fiber Type	Splice modes corresponding to different fibers have been stored in the database. The operator can choose the appropriate splice mode in the database according to different fiber types and copy it to the user splice modes.

Alignment	Setting fiber alignment method. "Precise": The fiber is aligned according to the the fiber core position and the cladding position at the same time. "Fiber core": The fiber is aligned according the the fiber core position. "Cladding": The fiber is aligned according the the cladding position.
Tension test	If "tension test" is set to "open", after the splicing is completed, the tensile test is performed automatically.
Cleave angle limit setting	Setting Cleave angle limit. When the Cleave angle of any of the fibers exceeds the limit, a limit alarm message appears on the screen.
Loss limit	When the estimated splice loss exceeds the setting splice loss limit, a limit alarm message appears on the screen.
Time for cleaning discharge	Cleaning discharge is a short duration arc and used to remove tiny dust on the surface of the fiber. Changing this parameter can change the length of the cleaning discharge time.
Manually adjusting arc time	Under certain conditions, the splice loss can be improved by more than one time of arc. Changing this parameter can change the length of the arc time.
Fiber gap setting	When setting the alignment and pre-arc, set the gap between right and left fiber end faces.

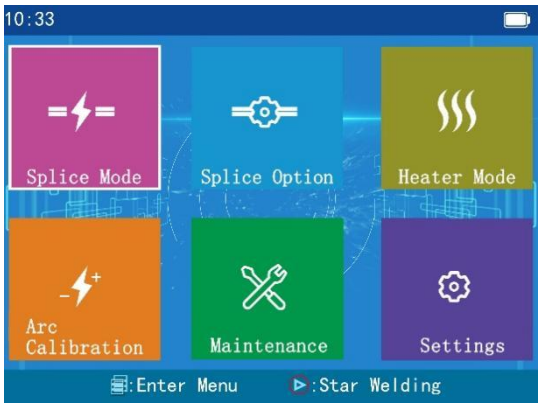
Splicing position setting	The relative position of the splicing place is set to the center of the electrode. Different types of fiber have different value of MFD. The operator can reduce the splice loss by moving the position of the gap near the fiber with larger value of MFD.
Fiber pre-melting strength	Set the pre-arc intensity in the process from the arc start to the fiber moving forward. If [pre-arc intensity] is too large, the end face of the fiber will be excessively melted. This will result in undesirable splice loss.
Fiber pre-melting time	Set the pre-arc time in the process from the arc start to the fiber moving forward. Long [pre-arc time] and big [pre-arc intensity] will lead to the same result.
Overlap	Set the amount of overlap of fiber. When [pre-discharge intensity] is set to be lower, it is suggested [overlap] is set to a small value, on the contrary, it should be set to a large value.
Intensity of arc 1	Arc can be divided into two stages and arc 1 is the first stage of arc. It sets the intensity of arc 1.
Time of arc 1	Setting the time of arc 1.
Intensity of arc 2 (Factory setting)	Arc 2 is the second stage of arc. It sets the intensity of arc 2.

Time of arc 2 (Factory etting)	Setting the time of arc 2.

3.2.2 Edit / select /restore

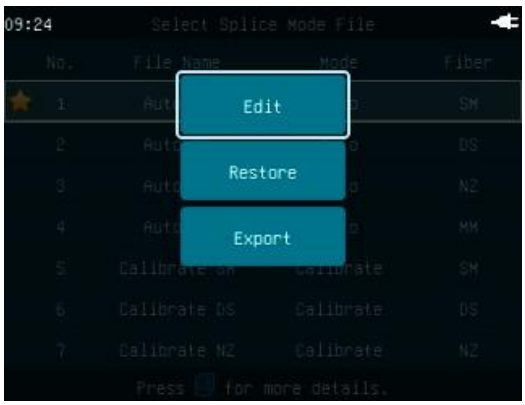
<1> Editing splice parameter files

On the readiness window as shown in the figure below, move the cursor on [Splice Mode] and click button and come to the window of [select splice parameter files], where "☆" No. 1 is the "splice parameter files" of current default splice.

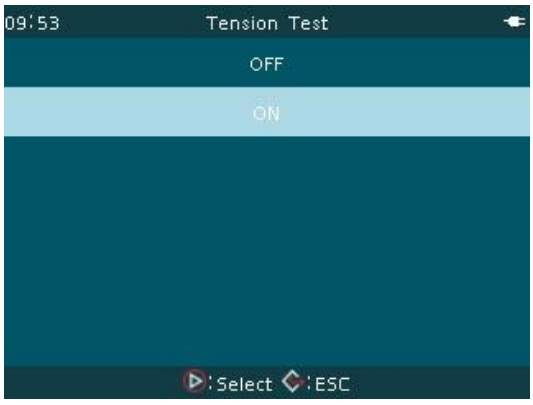


If the operator wants to add "tension test" function in the current fiber splicing point. The operator shall modify the default splice parameters. The steps of "Edit" splice parameter file are as follows:

A.On the window of [select splice parameters file], select "☆" no. 1 and click button and "Edit, Restore, Export" option window appears. Move the cursor to "Edit" and click button. "edit splice parameter files" window of current default splice appears.



B.Move the cursor to "tension test" item and click button. "close, open" options window appears. Move the cursor to "open" and click button, no. 1 splice parameter "tensile test" is opened.



C.Press continuously button to return to the readiness window. "tension test" on the fiber splice point is performed once the fiber splicing is completed.

<2> Select splice parameters file

If the user's current splicing environment, including atmospheric pressure, temperature, etc., has been greatly changed with the last splicing environment, in order ensure that the fusion splicing parameters under current harsh environment remain stable, the splice mode (calibrate) shall be changed.The steps of "select"

splice parameter are as follows:

A.Move the cursor to no.5 in the window of [select splicing parameter files] and click  button. "Edit, select, delete, export" option window appears. Move the cursor to "select" and press  button or button, "☆" no. 5 is the "splice parameter files" of current default splice.

B.Press  button to return to the readiness window. The real-time automatic calibration can be realized in fusion splicing procedure, realizing finally the target to stabilize the fusion splicing parameters in harsh environment.

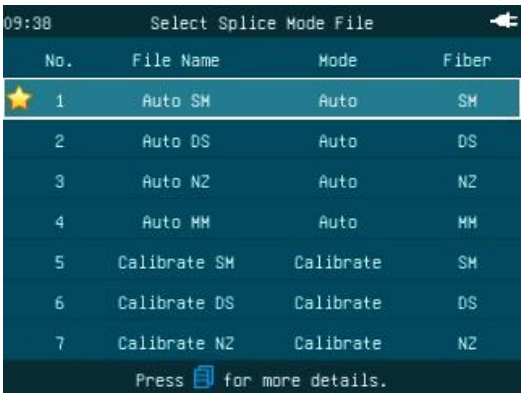
- **"Export, delete, import" and other operating options are the special features and are recommended to be used with caution.**

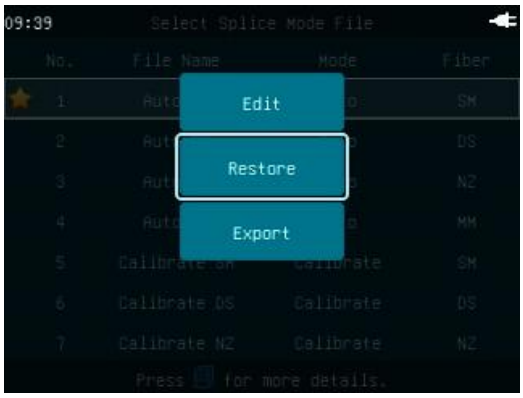
<3>

Restoring splice parameter files

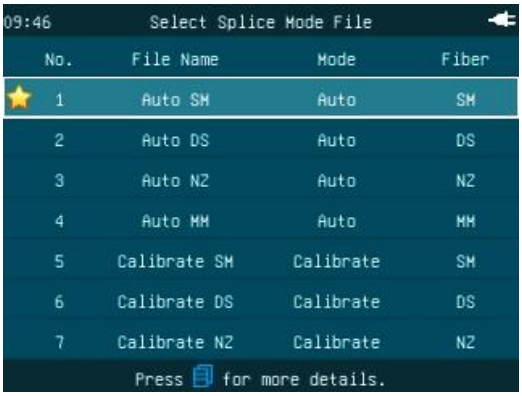
If "No. 1 to No.4 important splicing parameters" in the parameter file are not correct due to improper setting by the user, or the current splicing parameters deviate from the factory setting standard parameters due to improper software upgrade. When these incorrect parameters affect the optical fiber fusion splicer and the user can't correct these important splicing parameters, the operator can adopt following "restore" method to restore "No. 1 to No.4 splicing parameters" to the factory settings. "restore" splicing parameters steps are as follows:

A.When selecting "☆" No.1 in the window [select splice parameter files], click  button and "Edit, Restore, Export" option window appears. Move the cursor to "restore" column.





B.Press  button. "Continue to recover configuration data is displayed?" window appears. Continue to press  button. "No.1 to No.4 splicing parameters" are restored automatically to the factory setting.



C.Press  button to return to the standby window. The standard factory welding parameters are performed on the splicer, meeting the requirement of the user for splicing the different kinds of optical fibers.

3.3 [Heater mode] operation

3.3.1 Overview

A． [heater mode] has 40 built-in users heater modes (heating parameter files) for different types of fiber heat-shrink sleeve to be used by the users. There are nine default heater modes according to the length, diameter, material and other specifications of the fiber heat shrink sleeves, including: Standard, Micro 250, Micro 400 and Micro 900 and so on. Each set of heating parameter files include the options, important parameters and so on in process of fiber heat-shrink sleeve heating.

B.[Heater mode] has also 11 built-in factory modes (library), i.e. 11 sets of heating parameter files for the special use by the users (The heating parameter files in the factory mode "Library" shall be introduced into 40 groups of users heater modes).

C.Description of menu of "select heating parameters file"

In different "mode" settings (including: Standard, Micro 250, Micro 400, Micro 900 and so on), the users can open same splice parameter files. Press  or  button and switch over different windows. Press  button in turn to return back to the original operation window.

Description of heating parameter files

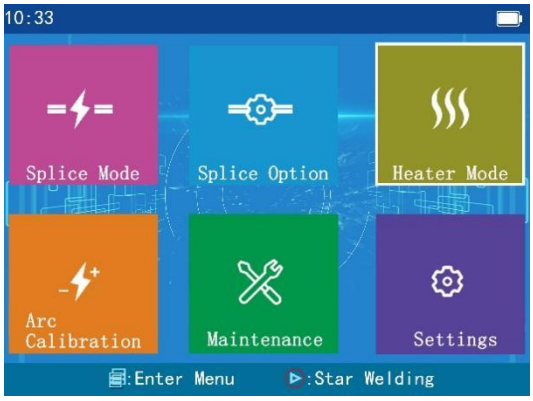
Parameter	Explanation
File (name)	Heating parameter file name is up to 16 characters for users.
Material type	Setting material of heat shrink sleeves: Standard, Micro 250, Micro 400, Micro 900 and connector and so on.
Length category	Set the length of heat shrink sleeves: 60mm, 40mm, 20mm and so on (Some functions are optional).
Heating control	Heating control includes "Automatic" or "Manual" optional function.
Heat time	Setting the holding and delaying time of "heating temperature".
Heating temperature	Setting the thermostat heating temperature.

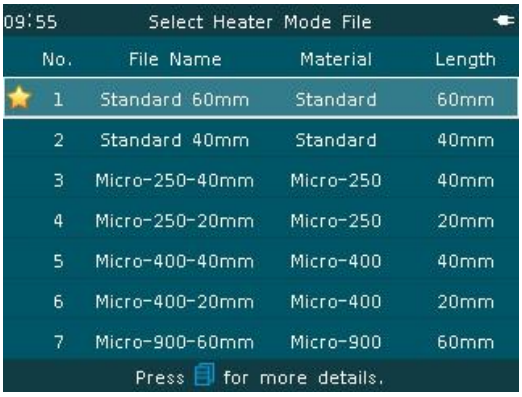
Heating end temperature	Setting the heating end temperature. When the heater is near this temperature, the buzzer alarms. At this moment, the heater has been cooled and can be removed from the furnace.

3.3.2 Edit / Select

<1> Editing heating parameter files

In the readiness window as shown in following figure, move the cursor to [heater mode] window and click button, Come to the window of [select heating parameters files], where " ☆ " no. 1 is the current default "heating parameter files".

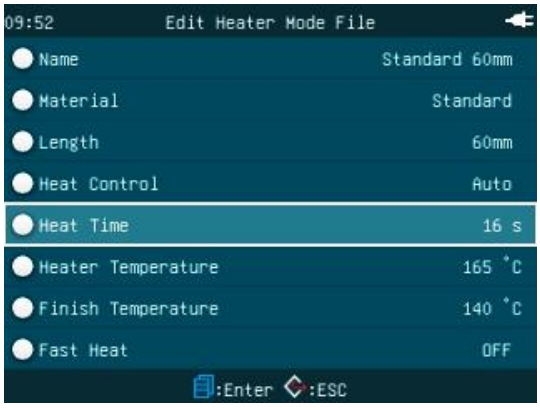




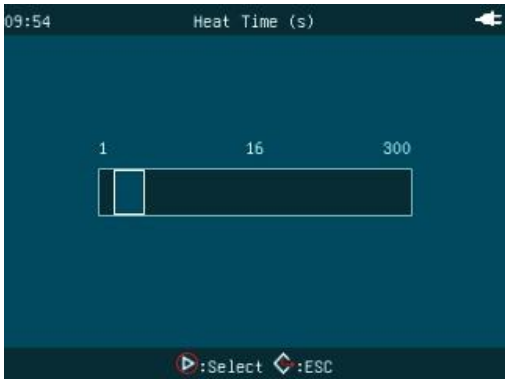
The operator can adjust the heating parameters and options according to the demand. If the operator wants to add "Heat time" function due to the special needs of heat shrink sleeve, the operator shall modify the machine default heating parameter value. The steps of "edit" heating parameter document are as follows:

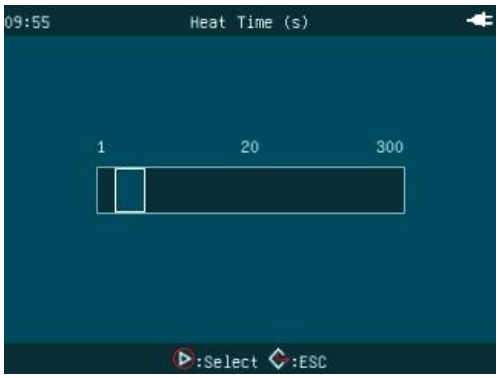
- In the window of [select heating parameter files], select " ☆ " no.1 and press button. "Edit, Export" option window appears. When the cursor moves to "edit" and click button, the current default "editing heating parameter files" appears

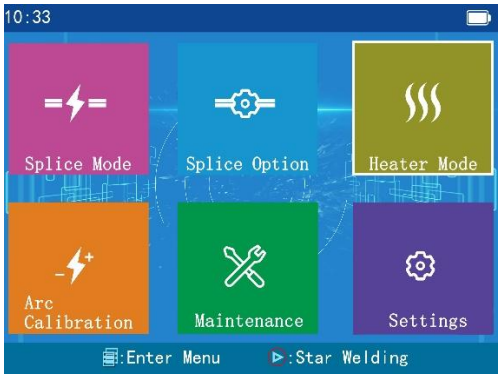
.

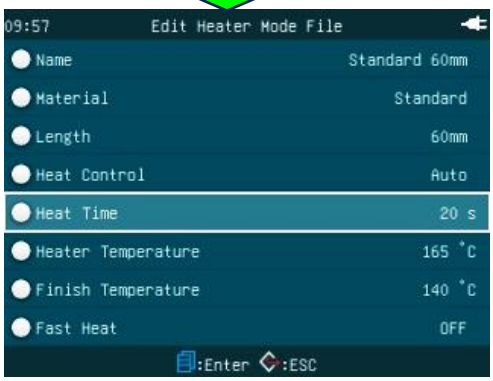


B.When the cursor moves to "Heat time", click button, "Heat time" window appears. Click or button to increase the value to "20". Press again buttonto confirm that the modified value is valid.No.1 heating parameter has "Heat time 20s".







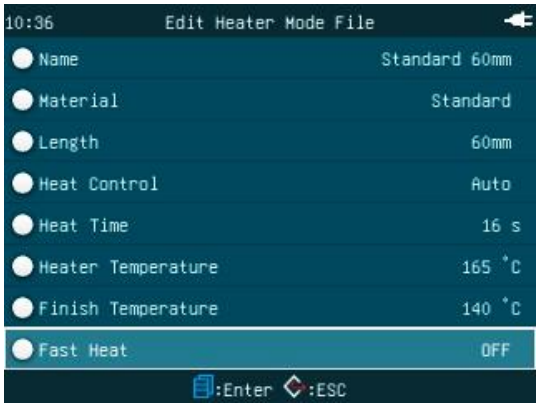


C.Press continuously button, the machine is returned to the readiness window.

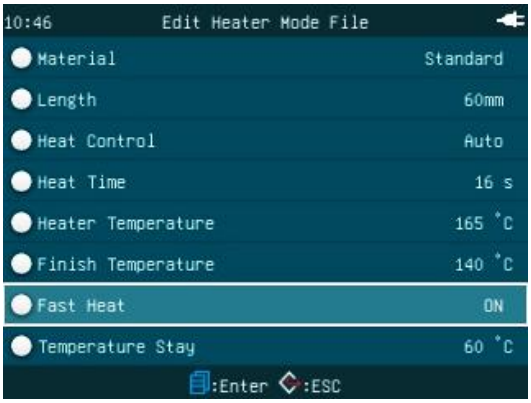
"Heat time" of the heater of the machine is 20s in each time.

In this model of the splicer, the shrink sleeve can be installed in lower ambient temperature by "fast heat" function. When selecting "fast heat: open", the heater of the splicer will always be at "temperature stay: 60 ℃ " thermal equilibrium condition, effectively reduce the waiting time of the heater in cold start-up. The user can improve the efficiency of shrink sleeve installation under lower temperature. This option is designed only for low temperature shrink sleeve installation. Under normal temperature or high temperature working environment, "open" is not recommended. Otherwise, this option will reduce the splicer's built-in lithium battery endurance, so this option is set to "off" in default for this model of the splicer. The steps of "editing" heating parameter document are as follows:

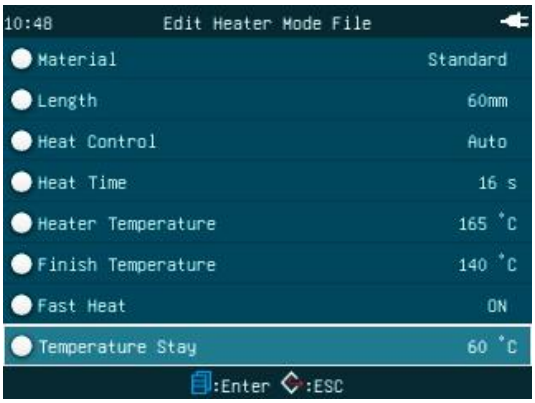
D.In the window of [select heating parameter files], the operator selects " ☆ " corresponding heating parameter files (such as No. 1) according to heat shrink sleeve specifications. Press  button, "Edit, Export" option window appears.When the cursor moves to "edit", click  button and come to the window of "edit heating parameter file". The cursor moves down again to "fast heat".

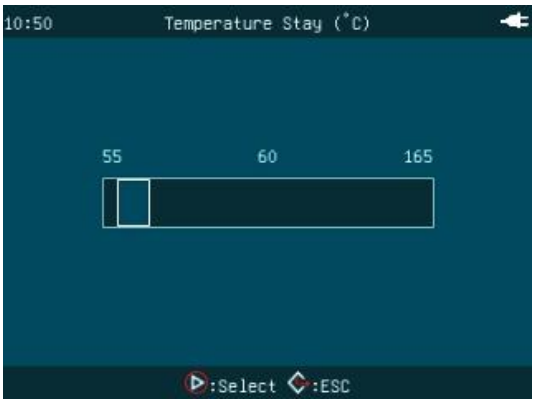


E.Press button again.Press button to select "open" function. Press button and come back to the window of "edit heating parameter file".Press continuously button to return to the readiness window.The heater of the splicer will always be at "temperature stay: 60℃" thermal equilibrium condition,



F.The factory default "temperature stay" of the heater of the splicer is at 60℃. Setting range: 55-165℃. The operator shall select the applicable temperature according to the application requirement of low temperature environment.





<2> Select heating parameter files

If the operator adopts "Micro- 900" heat shrink sleeve, in order to meet the quality requirements, the operator shall select the heater mode of corresponding "material category". The steps of "select" heating parameter are as follows:

A.In the window of [select heating parameter files], move the cursor to no.7, press button. "Edit, select, delete, export" option window appears. When the cursor moves to "select"and click button , where "☆" no. 7 is the current default "heating parameter files" of the machine,

B.Press button to return back to the readiness window. The machine implements "Micro-900" heater mode in heating operation each time.

● **"Export, delete, import" and other operating options are the special features and are recommended to be used with caution.**

★ **SS413F optical fiber fusion splicer heater temperature range is 100~ 165℃. The machine can normally satisfy the thermal shrinkage function under different temperature conditions in normal operation. It is forbidden to use hard objects and external force to press "U" heating groove, as the heater will be damaged therefore and cannot be used.**

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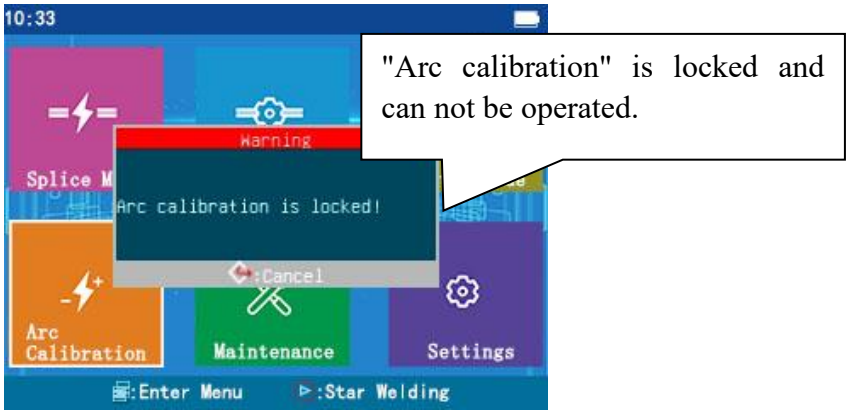
3.4 [Calibration] operation

<1> The temperature, barometric pressure and humidity in the operating environment are always changed. The fusion splicers are equipped with temperature and barometric sensors. The amount of change in the external environment can be transmitted in real time to the control system, thus ensuring the arc intensity of the machine is always in a state of balance, in which, electrode wear itself, fiber debris bonding may cause the change of arc intensity. Left or right offset and other abnormal circumstances of the arc center can not be corrected by the fusion splicer sensor only. So the operator shall adjust the arc to compensate the arc intensity, offset of the fiber splicing position relative to the arc center.

- In "Auto" and "Calibrate" splicing modes of SS413F optical fiber splicer, in the full scope of the work environment (including the combination of extreme working conditions), the splicer has the functions of work environment self adaptive, electrode oxidation self adaptive, real time splice arc control and calibration function.

  As "arc calibration" function of SS413F fusion splicer is stopped at the factory,

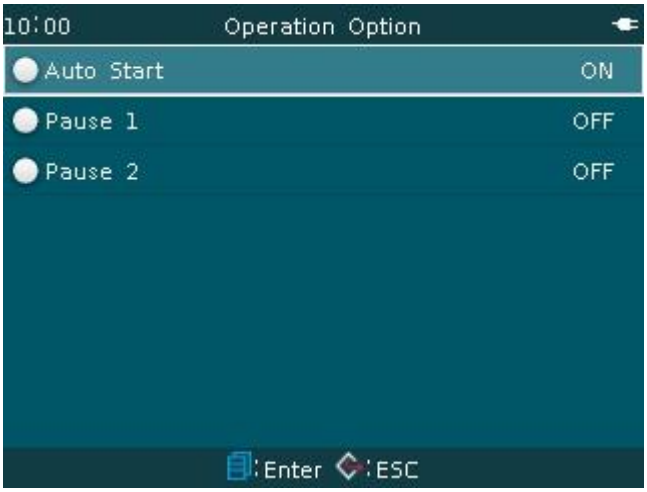
<2> Starting up is locked in "Calibrate"window of the primary menu and can not be operated.



3.5 [splice options]

[splice options] window provides a number of important splicing options. In the readiness window as shown in following figure. Move the cursor to [splice options] window and click  button to enter "edit splicing operation option" window. The important splicing options can be set.

3.5.1 Fusion splicing operation:

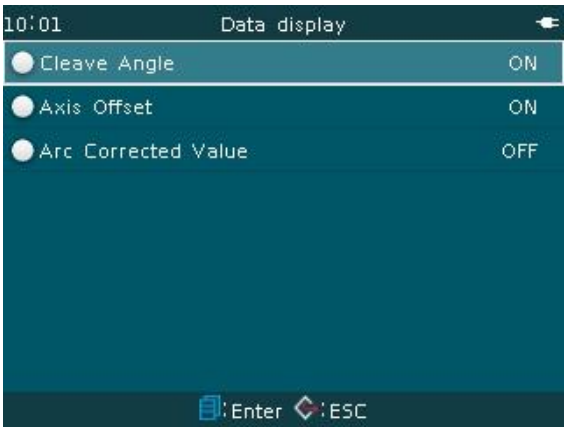


Parameter Description Table:

Parameter	Explanation

Auto start	Setting "On": The fiber will be spliced automatically when the wind cover is closed, the operator is required to prepare the fiber in advance and put it into the machine. Setting "Off": The window "click button for start" appears automatically when the wind cover is closed.
Pause 1	If "Pause 1" is set to be "On", the fiber splicing process will stop when the fiber is pushed to the gap setting value. The operator can see the value of Cleave angle at the same time.
Pause 2	If "Pause 2" is set to "On", the fiber splicing process will stop when the fiber alignment is finished. The operator can see the offset of the fiber core and the offset of the cladding at the same time.

3.5.2 Data Display:



Parameter Description Table:

Parameter	Explanation
Cleave angle	If at "On" status, the Cleave angle of the right and left fibers after measurement by the machine is automatically displayed on the screen.
Axis offset	If at "On" status, the offset of the right and left fiber core and the offset of the cladding will be automatically displayed.
Arc corrected value	Factory setting

3.5.3 Ignore options:

Parameter Description Table:

Parameter	Explanation
Cleave	1.If it is set to "off", the splicer will judge and prompt

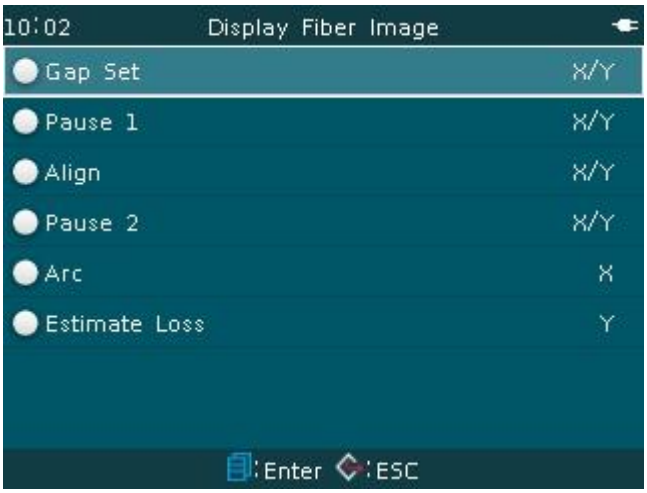
Loss Fiber core angle Bubble Thick Thin	automatically these overrun error messages in the process of splicing and suspend splicing operation, so that the operator can make again a good fiber end face and ensure splicing quality. 2.If it is set to "On", the overrun error messages will be ignored in the process of slicing, allowing to cut defective fiber and continue splicing process. The quality cannot be guaranteed.

3.5.4Arc compensation:

Parameter Description Table:

Parameter	Explanation
Pressure Temperature	If it is set to "On", arc intensity will be adjusted to compensate for changes in pressure and temperature.

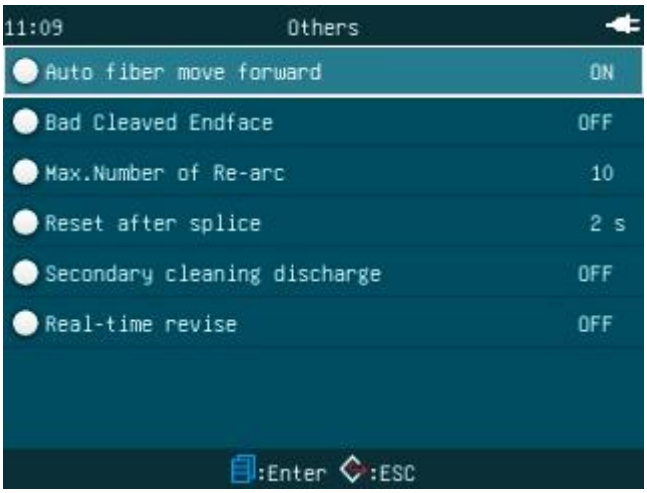
3.5.5 Display fiber image:



Parameter Description Table:

Parameter	Explanation
Gap set	Setting the display method of the fiber in the splicing process, having following options: X: X-field image is magnified. Y: Y-field image is magnified. X / Y: Vertical display of fiber image in X and Y fields X | Y: Horizontal display of fiber image in X and Y fields X: The image of X-field is magnified. Y: The image of Y-field is magnified.
Pause 1	
Align	
Pause 2	
Arc	
Estimate loss	

3.5.6 Others:



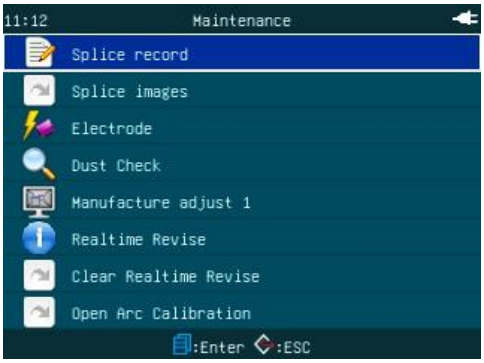
Parameter Description Table:

Parameter	Explanation
Auto fiber move forward	If [splice operation] "automatic start" is set to "On" : "Auto fiber move forward" setting is invalid, the fiber will be spliced automatically when the wind cover is closed. If "automatic start" is set to "No" : A."Auto fiber move forward" is set to "On" status:When closing the wind cover, the fiber is pushed into the screen. Press button again. The fiber is spliced automatically. B." Auto fiber move forward" is set to "No" status: When closing the wind cover, the fiber does will not go into the screen. Press button, the fiber is spliced automatically.
Bad cleavedend face	It is set to "On": If the fiber end face cleaved exceeds the limit value, the screen shows respectively "red unfilled corner" overrun alarm message on the left and right fiber end faces.

Max. number of Re-arc	Additional arc sometimes improves splice loss, but sometimes becomes worse. Multiple re-arcs may reduce the splice strength. This function can limit the number of re-arcs.
Reset after splice	After the fiber is spliced and the loss estimate is displayed, open the wind cover, but the machine is not reset. Press  button to reset. "2s": After the fiber is spliced and the loss estimate is displayed, open the wind cover, the machine is reset automatically after 2S delay. "0-120s": Delay time for the splicer automatic reset.
Second cleaning discharge	This function is mainly applied to "red light online fiber splicing operation", ensures more clean on the fiber end processed.
Real-time revise	SS413F optical fiber splicer has this function and is set at the factory.

3.6 [Maintenance] operation

[maintenance] window provides a number of important product maintenance options. In the readiness window as shown in following figure. Move the cursor to [maintenance] window and click  button to come into "maintenance" window. The important product maintenance options can be set.

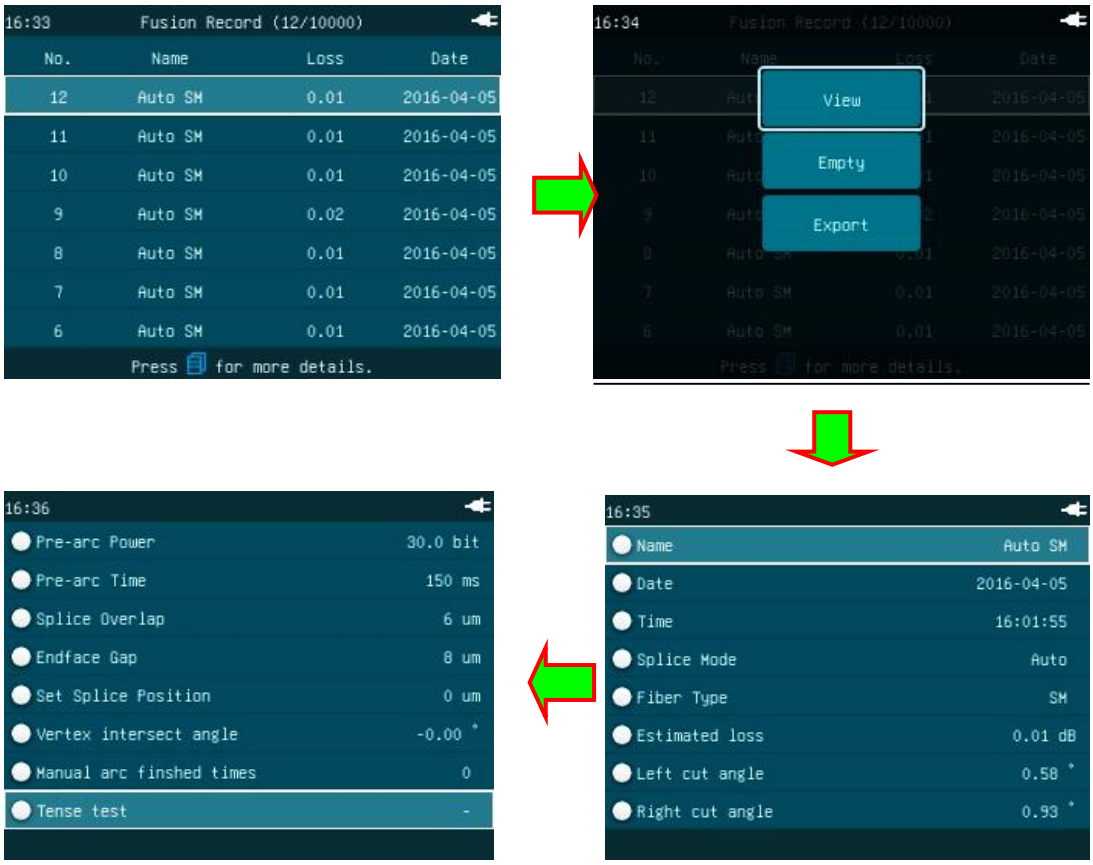


3.6.1 Splice records

"Splice record" provides the historic records of fiber splicing completed before. The machine can store maximum 10000 latest splice records.

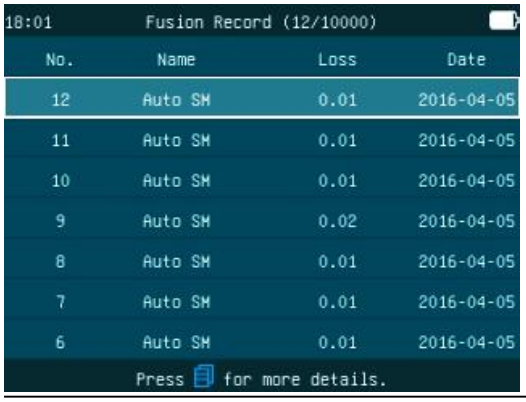
<1> Inspect splice records

In "splice record" menu, press button and"inspect, clear up, export" option window appears. When the cursor moves to "inspect" and click button, the window displays the detailed information of current splice record number, as shown in following drawing

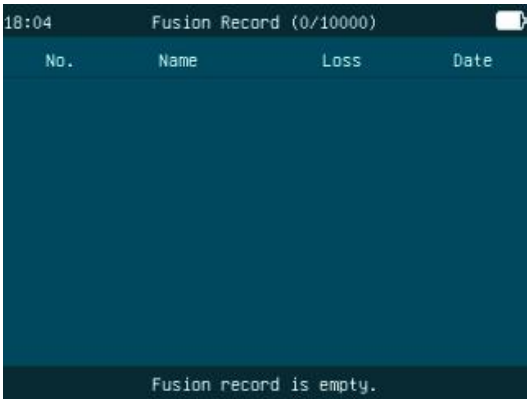


<2> Empty splice records

A. In "splice record" menu, press button and "view, empty, export" option window appears.



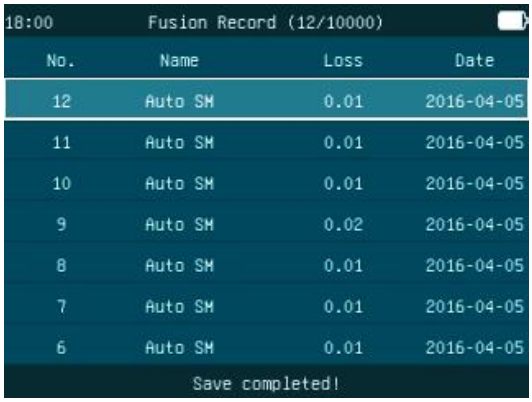
B.When the cursor moves to "clear up", click button. "Delete all records?" dialog box appears. If the operator confirms to clear up the current splice record, he presses button to delete all splice record information.



<3> Export splice record

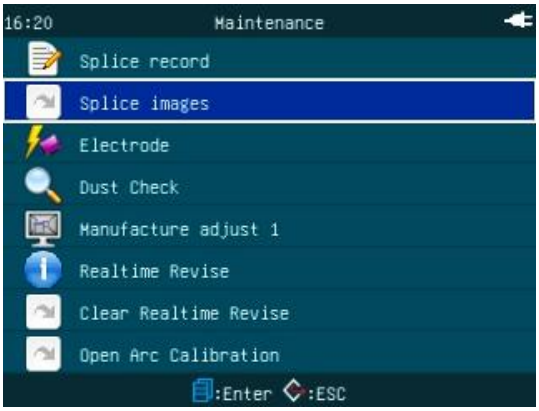
A. In "splice record" menu, press button."View, empty, export" option window appears. When the cursor moves to "export" and click button, "save record to USB storage?" dialog box appears.

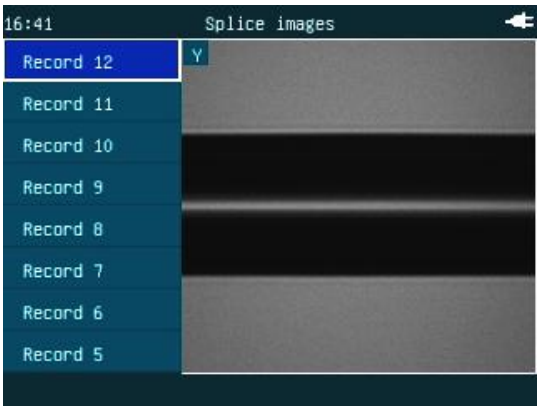
B.The operator can insert external USB flash disk correctly into USB2.0 port on the right side of the fusion splicer, then presses button, soon all splice record information is saved to the user's USB flash disk.



3.6.2 Splice images

"Splice image" provides the historic records of fiber splicing completed before. The machine can store maximum 100 spliceimages. (X, Y fiber spliceimages)





3.6.3 Electrode

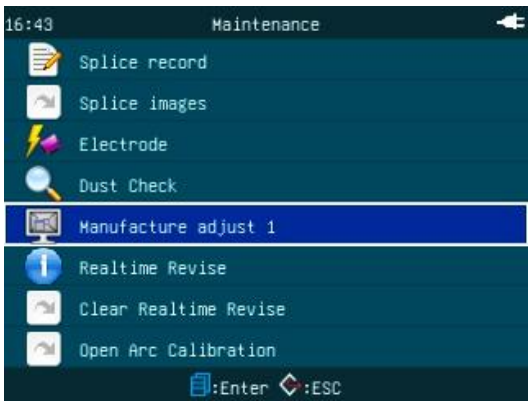
For the operations and requirements of the electrode, please refer to "5. Inspection and maintenance" of this manual.

3.6.4 Dust Check

For the operations and requirements of the dust checking, please refer to "5. Inspection and maintenance" of this manual.

3.6.5 Manufacture adjust 1

Manufacture adjust 1 belongs to the operation with permission under certain conditions. A.In the precondition the user can not splice the fiber at site and the splicer is unable to be sent back to the factory. B.In the situation the operator does not understand the daily maintenance of the machine. Under the precondition while the operation is not correct, but has not caused a hard fault of the parts, "Manufacture adjust 1" can be done under the guidance of the serviceman from the customer service center.



- **The operator shall master the routine maintenance knowledge and proper maintenance method of thesplicer.**

3.6.6 Real-time revise(see "4.1 real-time revise" of the manual)

SS413F splicer has "automatic splice arc strength control and correction" abilityin the full scope of the work environment(including the combination of extreme working conditions). "Real-time revise"belongs to factory default setting and shall not be set by the operator under normal circumstances.

Description of "Real-time revise" function and advantages

Model / Working environment	SS413F splicer **Has real time revise function.**	Other types of the splicers **Do not have real time revise function.**	Remark
Wider self adaptability (ambient temperature - 10～50°C, 0～5000m)above sea level)	When environment and time changes, the stable splicing effect can be achieved only after 1 to 3 times of preheat splices.	When the environment and time change, several times of "arc calibration" are required to get stable splicing effect.	When the environment and time change, the arc heat effect of the splicer under same arc calibration may be different and will have impact on the splicing result.
On the precondition meeting the low splice loss, the electrode has a longer service life.	According to the arc status of the electrode, the machine can automatically adjust the arc and get stable and low splice loss.	In order to satisfy low splice loss, several times of "arc calibration" shall be operated manually, to get the better effect of arc.	When the electrode has been used for many arcs, the electrode surface will be oxidized and worn out. The arc intensity will not be stable, that directly affects the optical fiber splicing effect.
Better experience	Several times of "arc calibration" are no longer required. In the process of "optical fiber splicing", the arc can be automatically calibrated.	If the user requires low splice loss, several times of "arc calibration" are required before splicing until "arc calibration" function is completed.	—

3.6.7 Clear real-time revise

A. Under "Auto - XX" and "Calibrate - XX" splicing modes, SS413F splicer has automatic splice arc strength control and revise function in larger range. The control and revise are closely related to optical fiber types. Therefore, the fibers set in "Auto - XX" and "Calibrate - XX" and the fiber to be spliced actually must

be same, otherwise, wrong revise will occur. If more seriously, the splicing will not be conducted. After the error occurs, under the condition the splicing is possible, the operator can select correct fiber for "preheat splicing" to correct mistakes. If splicing is not possible, the following methods shall be used for correcting mistakes:

①.Restore the factory setting.

As shown in following figure, move the cursor to "maintenance" window and select "Clear real-time revise" column. Press "Confirm" button. The real-time revise data is restored to the factory setting.

②.Preheat splicing (see section 4.1.1 of this manual)

After the real-time revise datais restored to the factory setting,the preheat splicing shall be

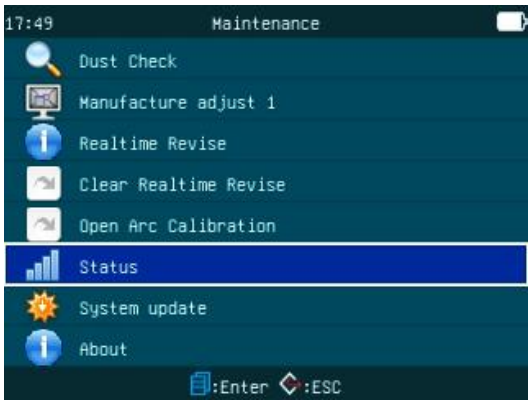
conducted. Through preheat splicing, the splicer automatically adapts to the environment, automatically adapts to the oxidation of the arc electrodes. SM optical fiber shall be used.Select "Calibrate - SM" splicing mode. Repeat 1 to 3 times of splicing. After the completion of preheat splicing, the operator can select any kind of splicing modes required to splice the corresponding optical fiber.

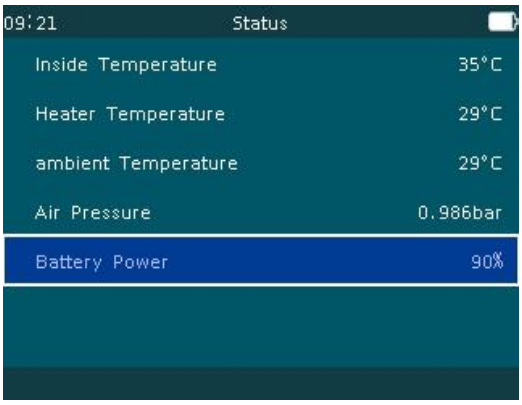
B.If the splicer is transferred from the original low atmospheric pressure work environment to the normal atmosphere working environment and the problem "left, right optical fibers are burn into two balls" occurs continuously, and the problems are not due to following reasons: the splicer press plate is loose; optical fiber coating layer is peeled; optical fiber is broken; propeling structure problem; high voltage power failure. "Clear real-time revise data" operation is applicable to solve the problem of fiber "balling".

3.6.8 Open arc calibration (see section 3.4 of the manual)

In "Auto" and "Calibrate" splicing modes of SS413F splicer, in the full scope of the work environment (including the combination of extreme working conditions), the splicer has the functions of work environment self adaptive, electrode oxidation self adaptive, real time splice arc control and calibration. Therefore, "shrink arc calibration" function is stopped in the default factory setting. No "manual arc calibration" is needed .

3.6.9 Status



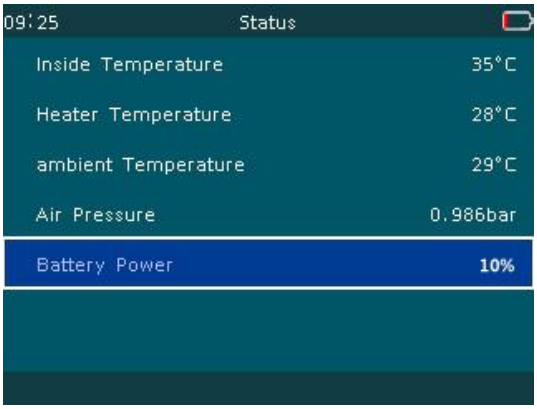


Parameter Description Table:

Parameter	Explanation
Internal temperature	Monitoring the ambient temperature of the circuit board inside the machine.
Heater temperature	Heater operating temperature is used by the operator to monitor the temperature change process of the heater.
Ambient temperature	Monitoring the environment temperature in present fiber splicing process. It offers self-calibration compensation amount. Temperature range of SS413F splicer: - 35 ℃ ~ + 60 ℃ operating environment.
Atmospheric pressure	Monitoring the ambient pressure in present fiber splicing process. Elevation range of SS413F splicer: 0 ~ 5000m operating environment.

Battery capacity	Battery feed mode: Dynamically displaying the capacity (percentage) of current lithium battery. Power adapter feed mode: Not displaying the capacity (percentage) of current power supply.

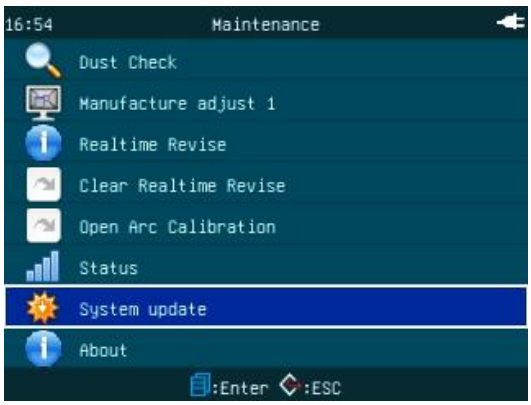
- **When the lithium battery power <10%,the machine alarms automatically with "low battery" window. The splicer beeps for 30 seconds and shuts down automatically.**



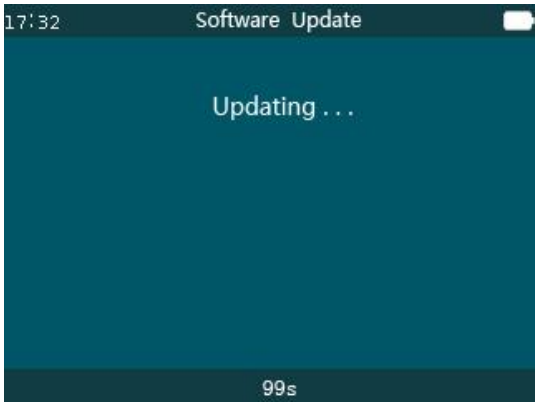
3.6.10 System upgrade

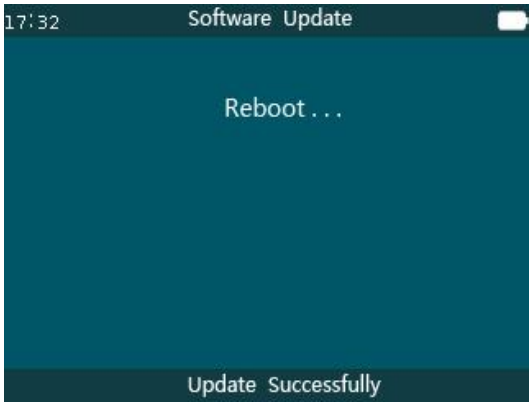
Based on the design concept for the convenience of users and for the sake of users, the software upgrade of SS413F optical fiber fusion splicer adopts 2.0 USB flash disk (hereinafter referred to as USB flash disk):fast and simple. The operation steps are as follows:

A. When the cursor moves to "system update" column and click  button, "Please insert the sub device that contains update package before continue!" dialogue box appears.



B. The operator shall insert USB flash disk containing the update package correctly into USB2.0 port on the right side of the fusion splicer and then press button.The screen displays "in process of updating..." and time. After about 120S, the screen displays "Reboot... update successfully". The fusion splicer restarts automatically and returns to the readiness screen.





C.Precautions on "USB flash disk" application

- **"Software update compression package" in the user USB flash disk must be extracted to the root directory of USB flash disk used at present.**
- **Before using USB flash disk, the operator must confirm its properties, namely the file system is "FAT32".Otherwise, USB flash disk shall go "formatting".**

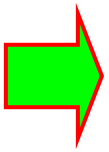
USB flash disk "format" steps are as follows:

<1> Insert USB flash disk into the computer's USB port. Move the cursor to "My Computer" and double click the mouse to open "My Computer" desktop and find "KINGSTON (H)" folder.

<2>

Move the cursor to "KINGSTON (H)" and right click the mouse. The following dialog box appears. Move again the cursor to "format (A)" item.

Open (0)
Resource manager (X)
Use ACDSee to browse
Command prompt
Search (E)...
Share and security (H)...
Use 360 antivirus scan
Use 360 file fort protection
Start decryption process
Start outbound process
Use 360 force delete
Encrypt file manually
Format (A)...
Pop-up (J)
Shear (T)
Copy (C)
Create a shortcut (S)
Rename (M)
Attribute (R)

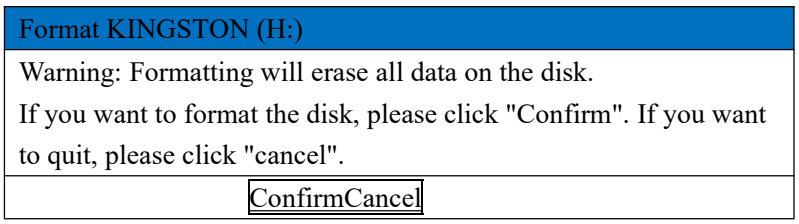


Open (0)
Resource manager (X)
Use ACDSee to browse
Command prompt
Search (E)...
Share and security (H)...
Use 360 antivirus scan
Use 360 file fort protection
Start decryption process
Start outbound process
Use 360 force delete
Encrypt file manually
Format (A)...
Pop-up (J)
Shear (T)
Copy (C)
Create a shortcut (S)
Rename (M)
Attribute (R)

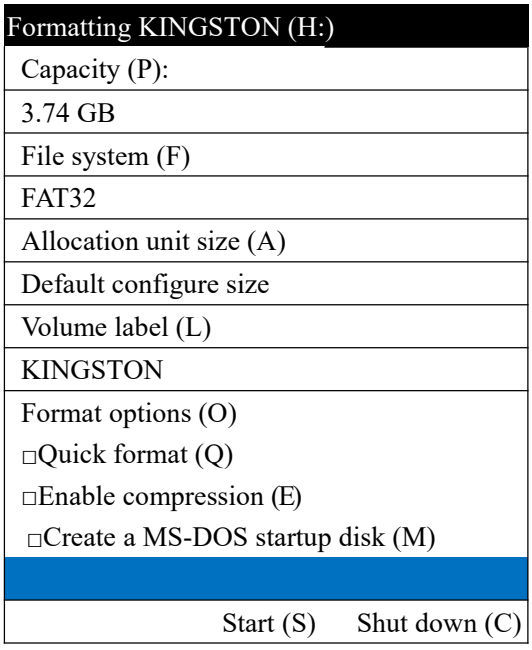
<3> Left-click the mouse. The following "Format" dialog box appears.

Formatting KINGSTON (H:)
Capacity (P):
3.74 GB
File system (F)
FAT32
Allocation unit size (A)
Default configure size
Volume label (L)
KINGSTON
Format options (O)
□Quick format (Q)
□Enable compression (E)
□Create a MS-DOS startup disk (M)
Start (S) Shut down (C)

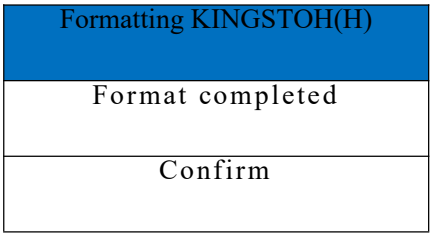
<4> Move the cursor to "Start (S)" window and left click the mouse. Format warning dialog box appears.



<5> Move the cursor to "confirm" window and left click the mouse. Format progress dialog box appears.



<6>Formatting operation will be done quickly. "Format Complete" dialog box appears.

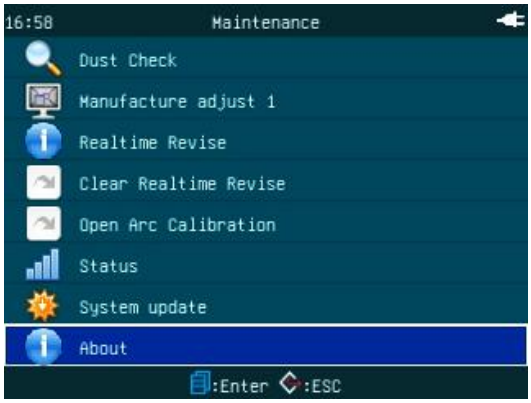


<7>Move the cursor to "confirm" window and left click the mouse. "Format" dialog box appears once again. Move the cursor to "close" window and left click the mouse. 2.0 USB flash disk formatting operation is complete. Finally, USB flash disk is removed safely from the computer.

Formatting KINGSTON (H:)
Capacity (P):
3.74 GB
File system (F)
FAT32
Allocation unit size (A)
Default configure size
Volume label (L)
KINGSTON
Format options (O)
□Quick format (Q)
□Enable compression (E)
□Create a MS-DOS startup disk (M)
Start (S) Shut down (C)

3.6.11About

"About" provides the model, serial number, software version and related hardware information of the fusion splicer.



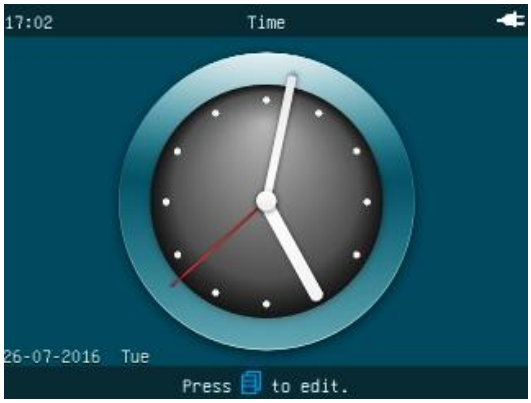
3.7 [Settings] Operation

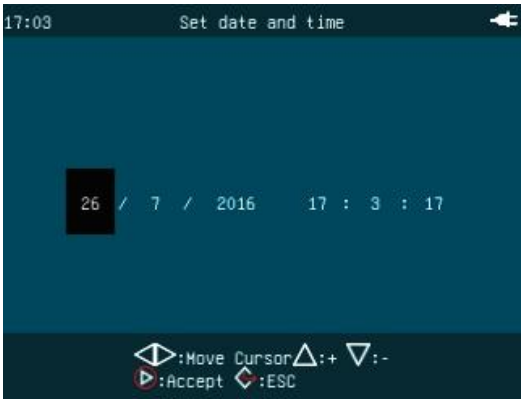
[Settings] application menu is provided for the convenience of users.In the readiness window as shown in following figure,move the cursor to [settings] window and click button to enter the "Settings"window. The corresponding options can be set.

3.7.1Time

The fusion splicer provides Beijing "Time" setting. The operation steps are as follows:

<1>In "Settings" menu, move the cursor to "Time" column and press button."Time" setting window appears.Continue to press button to show "Set Date & Time" and detailed time information.

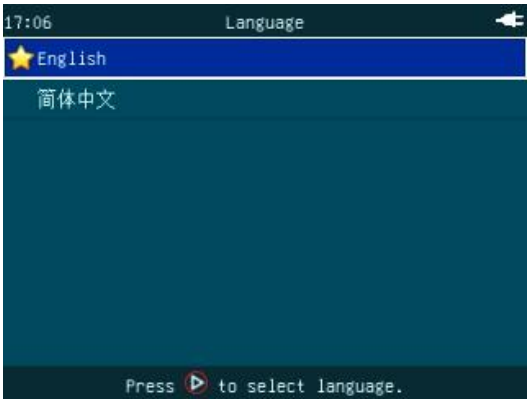




<2>In "Set Date & Time" screen, according to the "keypad prompt bar" at the lower portion of the display screen, review and adjust Year, month, day, and Beijing time.

3.7.2 Language

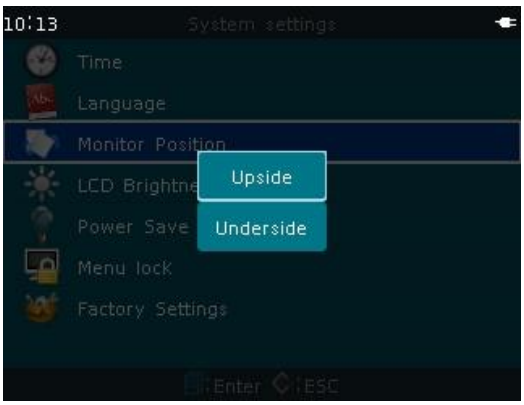
SS413F splicer has built-in language packs, including Chinese, English, French and other languages, total dozen of choices to meet the domestic and overseas users. According to market demand, the factory can also add new language (language pack).



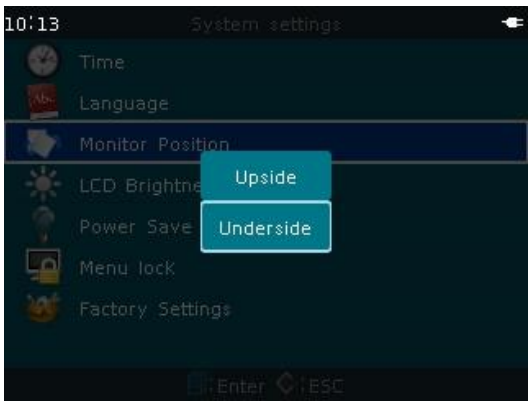
3.7.3Monitor Position

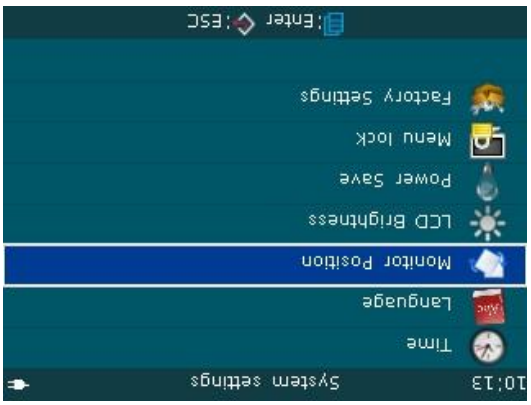
In order to meet user demand in a special environment, SS413F splicer is equipped with monitor frame rollover function. There are upside and underside options. The rollover operation steps are as follows:

<1> In "Settings" menu, move the cursor to "monitor position" column and press button."upside, underside" option window appears.



<2> When the cursor moves to "down", continue to press button, all currently displayed menu and fiber splicing windows of the fusion splicer can be rollover,meeting the operator's operation demand.





3.7.4 LCD brightness

For LCD brightness operation and requirements, refer to "2.7 LCD Brightness Adjustment" of the manual.

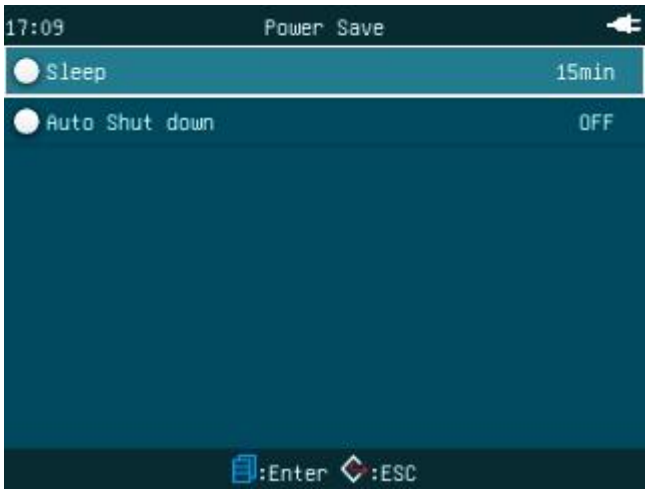
3.7.5 Power save menu

This function is very important to improve lithium battery duration and battery life. When this function is turned on, the fusion splicer does not operate within the set time. It will automatically enter the sleep state or power off.

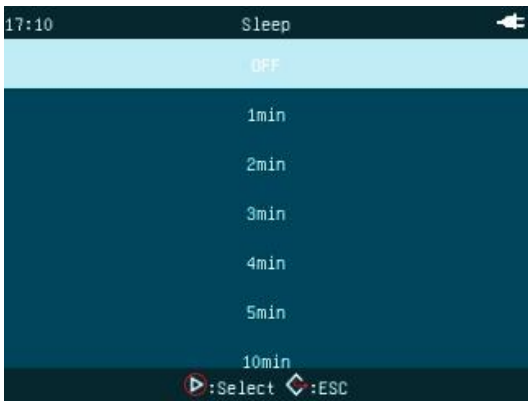
<1>

Sleep Settings

"Sleep" default setting of SS413F optical fiber fusion splicer is 15 min. When the operator does not operate the keypad of the fusion splicer within 15 minutes, the machine will automatically enter sleep (display and electric circuit etc.closed). If the operator operates any buttons on the keypad, the fusion splicer can wake up at any time to work.



A. In "Power Save Menu" screen, move the cursor to "sleep" column and press button to enter "sleep" time option setting window.Sleep time setting range is "1 ~ 60min" or "off". If moving the cursor to "off" column and pressing button, the sleep time of the fusion splicer is set to "off": No sleep time is set in the splicer.

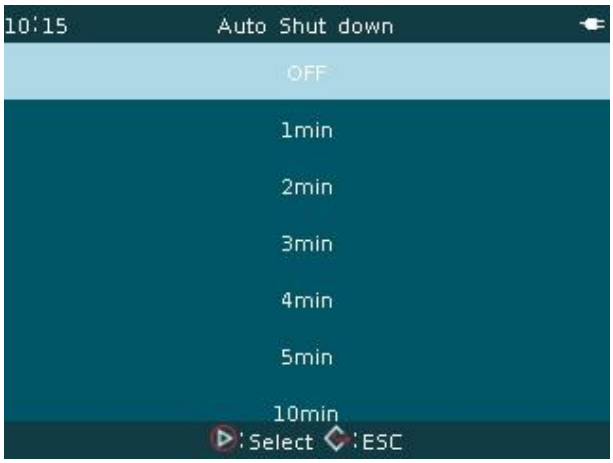


B. Press button to return back to the readiness window. The normal splicing operation can be done.

<2> Automatic shutdown setting

"Auto shutdown" feature of SS413F splicer is disabled by default at the factory.

A.In "Power save menu" screen, move the cursor to "automatic shutdown" item and press button to enter "Automatic shutdown" time option setting window. Automatic shutdown time setting range is "1 ~ 120min" or "off". Move the cursor to " ×× min" and press button.The current automatic shutdown time ×× min setting of the fusion splicer is effective.



B. Press  button to return back to the readiness window. The normal splicing operation can be done. When the operator does not operate the keypad of the fusion splicer after * * minutes, the machine will automatically enter automatic shutdown status.

Parameter Description Table

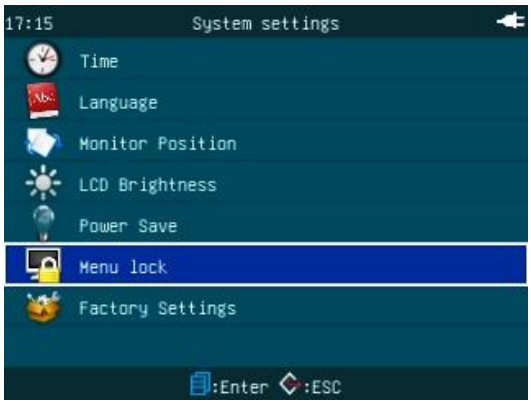
Parameter	Explanation
Sleep	When the user sets the sleep waiting time, if the fusion splicer does not operate within the set time, the fusion splicer will automatically turn off the display, the power consumption of the fusion splicer will be greatly reduced to prevent the big loss of the battery power. When the display is off, LED indicator next to  button is still green, the operator can press any button to wake up the machine, and resume the operation.
Automatic shutdown	After this feature is turned on and set automatic shutdown waiting time, if the fusion splicer does not operate within the setting time, the fusion splicer will automatically cut off the power supply.

3.7.6Menu Lock

In order to prevent incorrect operation of the machine, not cause the changes of the parameters of the machine, not affect splicing quality, to preserve the historic

records, such as machine splices, the administrator can lock the functions of relevant menu of the fusion splicer according to the need.

<1> In [Settings] menu, move the cursor to "Menu Lock" and press button to enter "Password" screen.Entera valid password to enter "Menu Lock" screen.



<2> The administrator can set "open" or "close" permission on the operating function based on the work. Lockable operating functions are listed in the table below.

Function Item	Explanation
Splicing file editing	On: First 12 of 100 groups of user mode parameters are locked and can not be edited. Off: First 12 of 100 groups of user mode parameters can be edited.

Heating file editing	On: First 9 of 40 groups of user mode parameters are locked and can not be edited. Off: First 9 of 40 groups of user mode parameters can be edited.
Splice Mode Library	On: 53 group factory mode splice parameters can not be imported into the user splice mode. Off: 53 group factory mode splice parameters can be imported into the user splice mode.
Heater mode library	On: 11 group factory mode heater parameters can not be imported into the user heater mode. Off: 11 group factory mode heater parameters can be imported into the user heater mode.
Remove splice records	On: The historic records of splice parameters are locked and cannot be deleted. Off: The historic records of splice parameters can be deleted.
Arc calibration	On: Arc calibration is locked and can not be operated. Off: Arc calibration can be operated.
Calendar	On: The calendar settings are locked and can not be operated. Off: Calendar setting can be operated.
Clear-up arc numbers	On: "Clear-up arc numbers" can not be operated. Off: "Clear-up arc numbers" can be operated.

Password	Password set by the fusion splicer administrator to access "menu lock" window.

3.7.7 Factory setting

"Factory settings" is used in the factory for machine software and hardware configuration and commissioning. The user can not access it, otherwise, the operation in error will lead to the result that the fusion splicer can not be repaired. They are protected by password.

4. High level operation

4.1"Real-time revise"

SS413F optical fiber splicer has set "Real time revise" in the factory and has "Real time revise" function. In "Auto" and "Calibrate" splicing modes, the splicer has the functions of work environment self adaptive, electrode oxidation self adaptive, real time splice arc control and calibrationin the full range of the work environment (including the combination of extreme working conditions). Therefore, under normal circumstances, the fiber can be directly spliced.

- In following cases, "preheat splicing" is required for SS413F optical fiber splicer. After the machine performance is up to the best state, the fiber can be spliced then.

  A.Environment changes, especially high altitude (atmospheric pressure) changes. B. Replacement of electrode. C. Normal or Special mode. D.Not used for a long-term.

4.1.1Preheat splicing

A. Automatic calibration of overall (complete machine)

Use SM optical fiber and select "Calibrate - SM" as the present splicing mode. Repeat 1 to 3 times of preheat splicing. After the completion of preheat splicing, the operator can select any kind of splicing mode required to splice the corresponding optical fiber.

B.Partialautomatic calibration(taking MM fiber as an example)

Use MM optical fiber and select "Calibrate - MM" as the present splicing mode. Repeat 1 to 3 times of preheat splicing. After the completion of preheat splicing, the operator can select "Auto - MM" or "Calibrate - MM" mode to splice MM fiber.

"Calibrate - DS/NZ" modes are similar to "Calibrate - MM" modes (omitted).

C."Auto - XX" mode:

"Auto - XX" mode has the automatic control and calibration function on strength of splicing arc, also has the effect of preheat splicing, but the calibration action is limited to this mode.

Use SM optical fiber and select "Auto - SM" as the present splicing mode. Repeat 1 to 3 times of preheat splicing. "Auto - SM" mode is up to the best condition now. The operator can splice SM fiber in this mode.

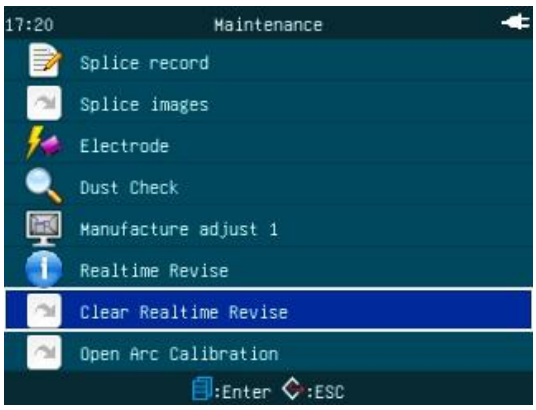
"Auto - MM/ DS/NZ" modes are similar to "Auto - SM" modes (omitted).

4.1.2 Special precaution

SS413F optical fiber splicer, "Auto - XX" and "Calibrate - XX" splicing modes, Has automatic splice arc strength control and calibration function in larger scope. The control and calibration are closely related to optical fiber type. Therefore, The fibers in "Auto - XX" and "Calibrate - XX" and the fiber to be spliced must be same. Otherwise, Wrong calibration will occur. Seriously, The splicing will not be conducted. After the error occurs, Under the condition the splicing is possible, Can choose correct fiber, For "preheat splicing" to correct mistakes. If splicing is not possible, The following methods shall be used for correcting mistakes:

A.Restore the factory setting,

As shown in following figure, move the cursor to "maintenance" window. Select "Clear real-time revise data" and press  button. The real-time revise data is restored to the factory setting.



B.Preheat splicing

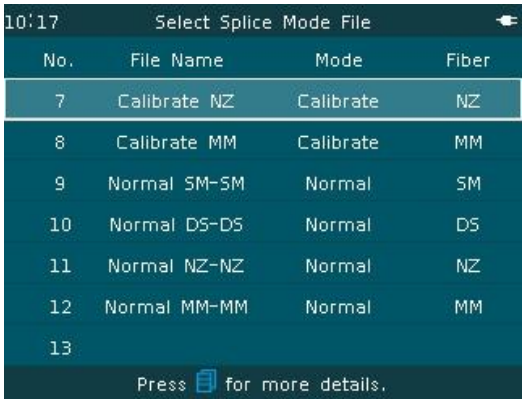
After the real-time revise data is restored to the factory setting, the operator must conduct preheat splicing.After preheat splicing, the splicer automatically adapts to environment and oxidation of the arc electrodes. Use SM optical fiber and select "Calibrate - SM" as the present splicing mode. Repeat 1 to 3 times of preheat splicing. After the completion of preheat splicing, the operator can select any kind of splicing mode required to splice the corresponding optical fiber.

4.2 Select splice mode according to the type of optical fibers

<1> Different fibers have different splice parameters. In the fiber splice operation, depending on the type of fibers to be welded, the user shall choose a suitable fiber

splice mode.

<2> In "Select splice parameter files" screen, there are a total of 12 sets of different kinds of fibers. Different modes can be selected and edited by the user as shown in following picture.



Description of some types of fibers:

Fiber Type	Explanation
SM	Splice standard single-mode fiber. MFD: 9-10μm wavelength: 1310nm
DS	For splicing dispersion-shifted fiber MFD: 9-10μm wavelength: 1550nm.
NZ	For splicing non-zero dispersion shifted fiber. MFD：9-10μm wavelength: 1550nm WDM fiber can be spliced in this mode.
MM	For splicing multimode fiber MFD：50.0-62.5μm

Description of some modes:

Splicing mode	Explanation
Auto	In the process of splicing, the splice arc intensity is adjusted and controlled automatically (only for the splice mode selected).
Calibrate	In the process of splicing, the splice arc intensity is adjusted and controlled automatically. The splice arc intensity is calibrated automatically. "Calibrate-SM":The arc intensity calibrated is effective in all modes; The arc intensity of all modes is calibrated. "Calibrate-MM":The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - MM" mode. "Calibrate-DS":The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - DS" mode. "Calibrate-NZ":The arc intensity calibrated is local effective; Calibrating the arc strength of this splicing mode and "Auto - NZ" mode.
Normal	Same type of fibers are spliced with the default factory optimized parameters.
Special	Different types of fibers are spliced with the default factory optimized parameters.
Other modes	In the splicer database, there are other splice modes different to the modes listed above. The new splice modes are constantly added. The users can contact their sales dealer and ask for the latest splice modes.

4.3 Selecting / editing splice mode

<1> Factory default optical fibers and splicing modes of SS413F optical fiber splicer (splice parameter file): No.1, Auto SM. If the user has not selected other "splice parameter files",No. 1 is used by default as "splice parameter files" in the current

operation of the fiber splice.

<2> When the machine is delivered, in "Select splice parameter files" menu, in number 1 to 8 splice parameter files, there are 9 operating parameters and options for the user to edit and select. In numbers 9 to 12 splice parameter files, there are 15 operating parameters and options for the user to edit and select;

<3> According to splicing demand, the user can select and edit the current"splice parameter files".For specific steps and requirements, please refer to "3.2.2edit/ select" of the manual.

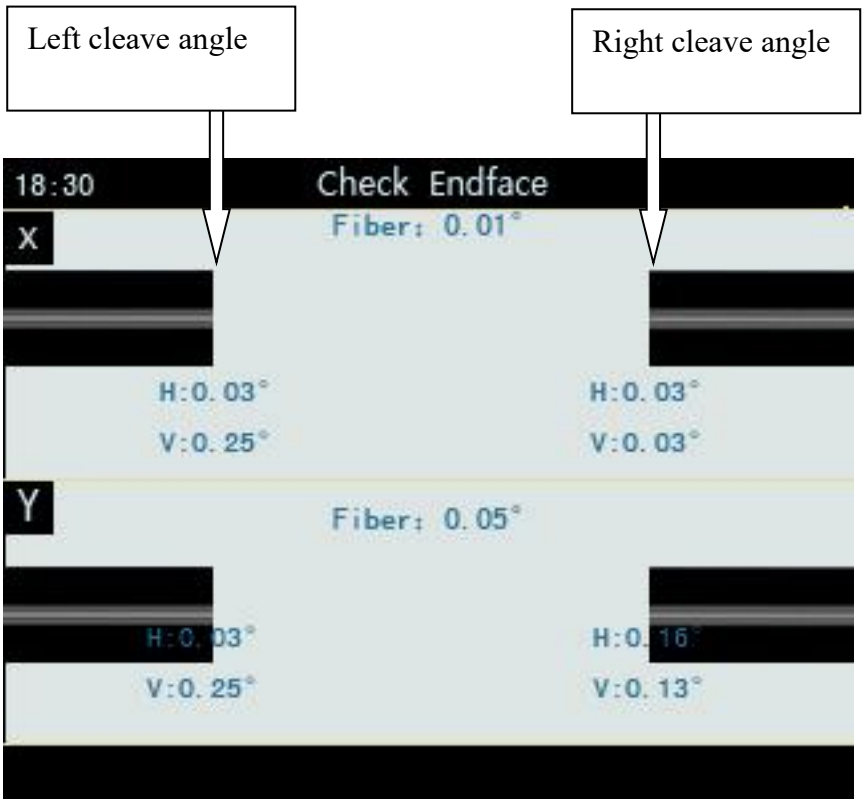
4.4 Fusion splicing operation

SS413F fusion splicer is provided with an image processing system to observe and inspect the optical fiber.However, in some cases, the image processing system may not discover fusion splicing errors. To achieve good splicing results, the operator requires using the display to monitor visually the entire splicing process of the optical fiber. The following describes the standard splicing steps.

4.4.1 Inspection of optical fiber cleave angle and end face of optical fiber

<1> Two optical fibers are loaded into the fusion splicer and are moved near. After cleaning discharge, two optical fibers are stopped respectively at a set position. Then check the cleave angle and the quality of the end face of each fiber. If the measured fiber cleave angle is bigger than the set limit (factory default value) and the end face of the optical fiber is found to have burrs, the machine alarms, at the same time, the display will show a overrun alarm message. Fiber splicing

process is paused automatically. To ensure the quality of splicing, the user is recommended to rework a good fiber end face and place the fiber once again.



Screen Data Description:

Fiber: Angle between the left fiber (extension line) and the right fiber (extension line) on X (Y) screen. H: Angle between the left (right) fiber and the horizontal line. **V:** Angle between the left (right) fiber end face and the vertical line.

<2> When there is no overrun alarm message display on the fusion splicer, the operator should also check manually the fiber end face. If the operator finds a situation similar to the following, he shall take the fiber away from the fusion splicer, and then prepare again the fiber, because the fiber surface defects may lead to a failure of the splicing.

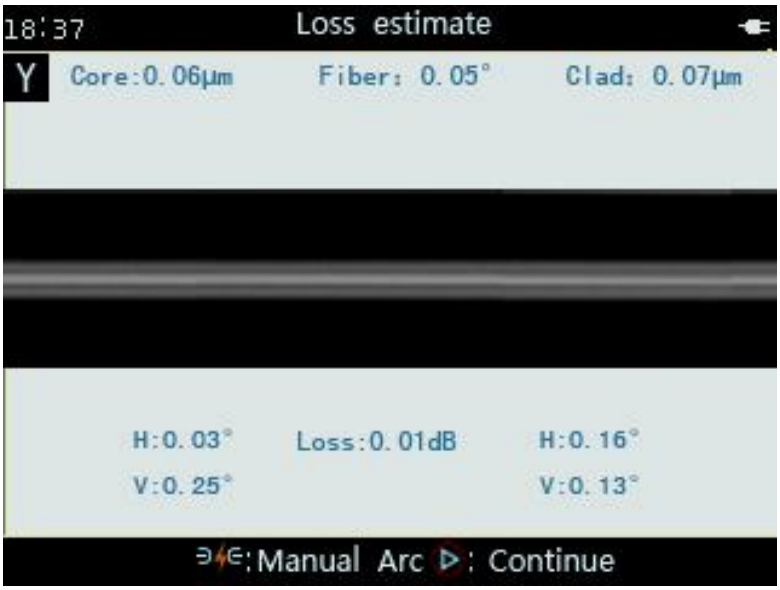
<3> Quality of the fiber end face has a great influence on the splice loss, so when cleaving the fiber, the operator shall try to make the fiber end face in a plane, and the angle of the plane with the cross section of the fiber is less than 1°. The end face in the following figure (a) is good and can be sliced; (b) ~ (f) are undesirable end facesand they shall be made again.

4.4.2 Automatic alignment and fusion splicing

After optical fiber inspection is complete, the fibers will be aligned according to the manner of "core to core" or "clad to clad". Then produce the arc and splice the fibers.

4.4.3 Estimation of splice loss

After fusion splicing is completed, the splice loss estimated value will be displayed.



Screen Data Description:

Core:The left fiber core is offset to the right fiber core. **Clad:** The left fiber clad is offset to the right fiber clad. **Fiber:** angle between the left fiber (extension line) and the right optical fiber (extension line) on X (Y) screen.**H:** Angle between the left (right) fiber and the horizontal line. **V:** Angle between the left (right) fiber end face and the vertical line.

If the fiber after splicing is checked out to have following abnormal circumstance, for example: too thick, too thin, or bubbles, the fusion splicer shows "fusion splicing failure"massageor "too large estimated loss value" message. When there is no error message displayed, but the splice result is found through the display to be very poor, it is proposed to make splice again.

- **The splice point sometimes looks "thicker" than the rest of the fiber, this is normal fusion splicing and does not affect splice loss.**
- **When the splice loss value exceeds the set alarm value, the machine shows red message to warn the operator. If this information is set not prompting, the user can edit "Ignore Options" (Section 3.5) menu in [Splice Options].**
- **In some circumstances, additional arcs can improve splice loss. Press button to add arcs. In some circumstances, additional arcs may increase splice loss. It is recommended to limitthe number of arcs. The user can edit it in "Others" (Section 3.5) menu in [Splice options].**
- **When different fibers (different diameters) or multimode fiber are spliced,**

sometimes a vertical line is produced at the splicing point. This does not affect splice loss and point strength.

Causes and solutions of increased splice loss are listed in the table below:

Phenomena	Causes	Solution
Fiber core axial misalignment	V-groove or fiber clamp are covered by dust.	CleanV-groove and fiber clamp.
Fiber core angle error	V-groove or fiber clamp are covered by dust.	CleanV-groove and fiber clamp.
	Poor quality of fiber end face	Check whether the fiber cutter works well.
Fiber core steps	V-groove or fiber clamp are covered by dust.	CleanV-groove and fiber clamp.
Fiber core bending	Poor quality of fiber end face.	Check whether the fiber cutter works well.
	Low pre-arc intensity or short pre-arc time.	▲ Increase "fiber pre-melting intensity". ▲ Increase "fiber pre-melting time".
Mode field diameter mismatch	Arc intensity is too low.	▲ Increase "arc 1 intensity". ▲ or "arc 1 time".
Dust	Poor quality of fiber end face.	Check the cutter working situation.
	Dust remains after cleaning fiber or cleaning discharge.	Clean thoroughly the fiber or increase "clean arc time".
Bubbles	Poor quality of fiber end face.	Check whether the cutter works well.
	Low pre-arc intensity or short pre-arc time.	A. Increase "fiber pre-melting intensity". B. or Increase "fiber pre-melting time".
Fiber separation	Fiber feed is too small.	▲Increase "overlap".
	Too high pre-arc intensity or too long pre-arc time.	▲Reduce "fiber pre-melting intensity". ▲Or reducing "fiber pre-melting time".
Too thick	Too low pre-arc intensity or too much feed of fiber.	▲Increase "fiber pre-melting intensity" ▲Or reduce "overlap".
Too thin	Inappropriate arc intensity.	Doing "arc calibration".
	Some arc parameters inappropriate.	▲Adjust "fiber pre-melting intensity", "Fiber pre-melting time". ▲Or adjust "overlap".

Fine Line	Some arc parameters inappropriate.	▲Adjust "fiber pre-melting intensity", "Fiber pre-melting time". ▲Or adjust "overlap".

Remark: ▲ This item can be edited only in "Normal Splice Mode".

4.5 Tension test

4.5.1 If the operator wants to test the strength of the splice point, enter the window of [select splice parameter files" in splice mode and enter "edit splice parameter document"window. Click the cursor mouse to select "tension test" function "On" option. Press  button to confirm that the setting is valid, then exit the readiness window.

4.5.2 After the machine finishes the normal connection, the splice loss estimate value is displayed. The operator presses the button "continue" at the lower portion of the display screen and press  button. The fusion splicer will preform automatically the tension test of the fiber.

4.5.3 When the fiber splice point is not broken during the tension test, it will show "tension test is completed."

- For the specific steps of tension test "On", please refer to "3.2.2 edit/ select" of the manual.

- **Factory default setting of splicing parameter "tension test" is "Off".**

- **If "splicing failure" appears in the fiber splicing,tensile test is not possible.**

4.6 Storage of spliced fiber

4.6.1 Upon the fiber splicing is completed and the loss estimate is displayed, the splice loss value, splice parameters, splicing time and other relevant information will be automatically stored in the machine's memory.

4.6.2 When 10000 splice results have been stored, the 10001 result will overwrite the first result.

4.7

Reinforcement of fiber splices

4.7.1 Selecting the heater mode according to heat-shrink sleeve material

<1> Different heat shrink sleeves have different specifications and sizes. When the users reinforce the fiber splice point, matching heat shrink sleeve shall be used. The heat shrink sleeve shall be operated according to the material type of the heat shrink sleeve used at present. The user shall choose a suitable heater mode.

<2> In "Select heater parameter files" screen, there are a total of 9 sets of different kinds of heat shrink sleeve modes, which can be selected, used and edited by the user, as shown in following figure.

Heater mode description:

Parameter	Explanation
File (name)	Heating parameter file name is up to 16 characters for users.
Materials category	Setting material of heat shrink sleeves: Standard,Micro 250, Micro 400, Micro 900 and Connector and so on.
Length category	Set the length of heat shrink sleeves: 60mm, 40mm, 20 mm, etc. Some length types are optional.
Heating control	Heating control includes "Automatic" or "Manual" optional function.

Heat time	Setting the holding and delaying time of "heating temperature".
Heating temperature	Setting the thermostat heating temperature.
Heating end temperature	Setting the heating end temperature. When the heater is near this temperature, the heating indicator is off, the buzzer alarms. At this moment, the heater has been cooled and can be removed from the furnace.

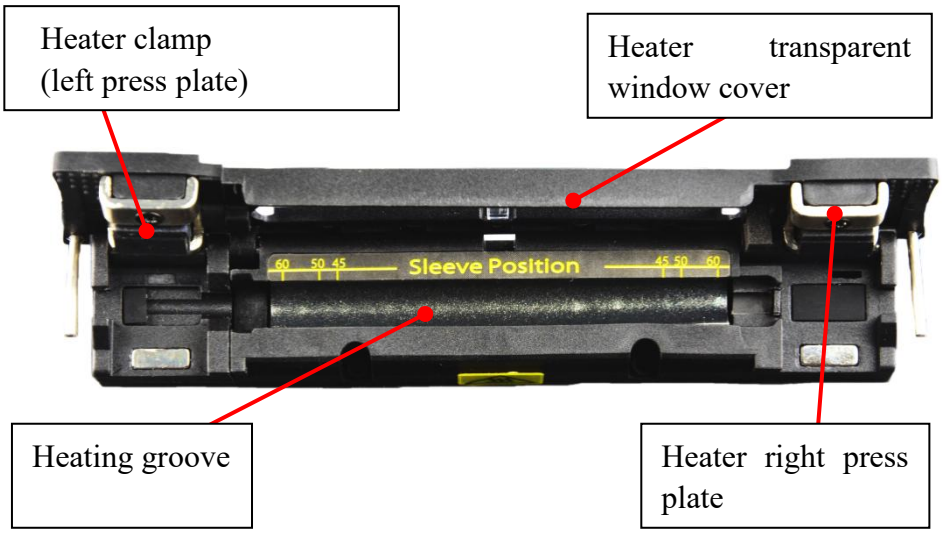
4.7.2 Selecting / Editing Heater mode

<1> SS413F fusion splicer factory default heater mode (heating parameter file): No. 1, standard 60mm. If the user does not select other series number "heating parameter files",No. 1 "splice parameter file" is used by default in the current heat shrink sleeve operation.

<2> When the machine is delivered, in "Select heater parameter files"menu, in numbers 1 to 9 splice parameter files, there are 9 operating parameters and options for the user to edit and select;

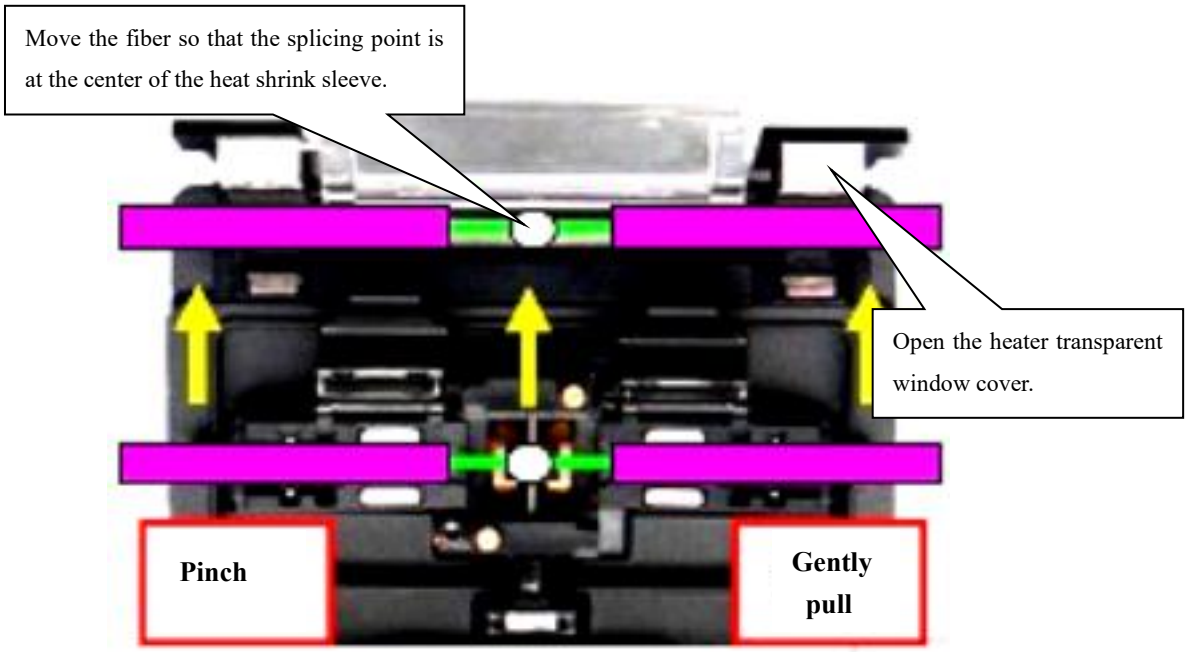
<3> According to fusion splicing demand, the user can select and edit the current"splice parameter files". For specific steps and requirements, please refer to "3. 3.2edit/ select" of the manual.

4.7.3 Heating operation



A.Manual heating control

<1> After opening respectively the heater clamp (left press plate) and the transparent window cover, hold the left end of the optical fiber attached with heat shrink sleeve with the left hand. Straighten gently the other end of the optical fiber with the right hand. The optical fiber is moved from the V-groove to the heater groove(as shown in the figure below).



<2> Determine the fiber splice point is placed at the middle position of heat-shrink sleeve. Then the heat shrink sleeve is put into the center position of the heating groove. Straighten gently the fiber. Close the heater transparent window cover (right press plate) and the heater clamp (left press plate).

- **The reinforcing core of the heat shrink sleeve is placed on the bottom and the optical fiber shall not be distorted .**

<3> Press the keypadbutton  to start heating. Heating processes are composed as follows: Start heating-up (LED red indicator), constant temperature stage (LED green indicator), cooling stage (LED red indicator). When heating is complete, the buzzer sounds. The heating indicator LED (red) is turned off automatically. If pressing  button in heating process, the heating process will be terminated.

<4> After opening the heater transparent window, the fiber has been protected by the heat shrink sleeve and the fiber can be removed.

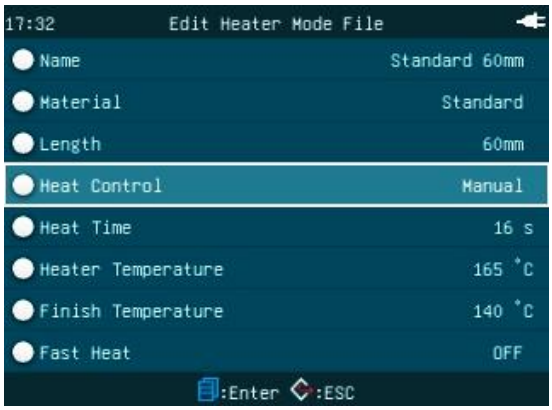
- **Heat shrink sleeve may be stained on the heating bottom plate of the heating groove,in this case, remove the heat-shrink sleeve by a cotton swab.**
- **Heater temperature in heating process is high. Do not touch the heating groove and heat-shrink sleeve .**

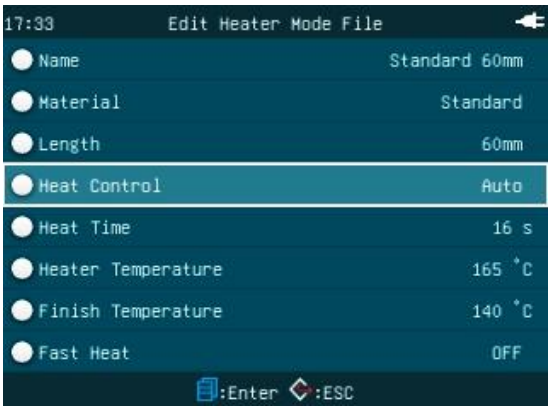
<5> Observe heat shrink sleeve after heating, qualified product inside is free of bubble and dust.

B.Automatic heat control

User-friendly heating operation, SS413F series of fusion splicers are provided with automatic heat control mode.

<1> Refer to "3.3.2 edit/ select" of the manual.in "Select heating parameter files" window, "Manual" of "heat control" is set to "Auto" mode,realizing automatic heater mode.





<2> When the operator puts the fiber heat shrink sleeve with fiber at the center of the heater groove,after the transparent window comes down and the heater's right press plate holds down effectively the fiber, the heater will work automatically. The processes also include heating-up, thermostat and cooling three-steps, finally the buzzer sounds.The heating indicator LED (red) is turned off automatically.

<3> When the operator needs to stop the heating operation of the heater in process of heating, the operator just presses keypadbutton  .

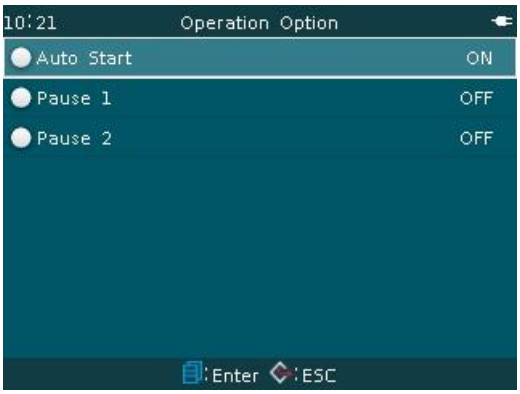
- **If the right press plate of the heater can not effectively hold down the optical fiber (or fiber-optic breaks by pressing), automatic heating is invalid.**

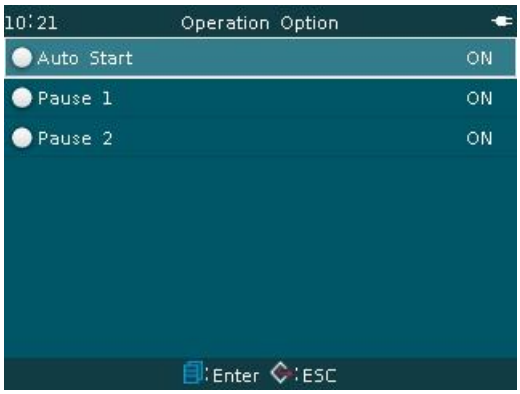
4.8 Motors operated manually

4 motors in the fusion splicer (feeding, aligning) can be operated separately and manually.

4.8.1 Select manual (step by step) splicing

In the "edit splice options" menu, select and enter "Splice Operation" window. Set"Pause 1", "Pause 2" to "On". When the fusion splicer performs the splicing process to "Pause 1" or "Pause 2" status, the motor will be automatically suspended. At this point the motor can be operated manually by the button.





4.8.2 Manual (step by step) splicing steps

<1> The machine goes from the automatic "feeding" and other actions to complete the fiber "gap setting" and is suspended in "Pause 1" screen.

"left fiber", "right fiber", "grid" dialog boxes can appear by pressing  button.Move the cursor and select "Left fiber (right fiber)" and then press  button.After confirming "Left fiber (right fiber)" operation items,the feeding and aligning motors of the left fiber (right fiber) can be set as follows.

<2> In the "left fiber" operation window, Press ▷ or ◁ button to moveX (Y) field left feed motor forward or backward. Press △ or ▽ to moveX -field alignment motor upward or downward.

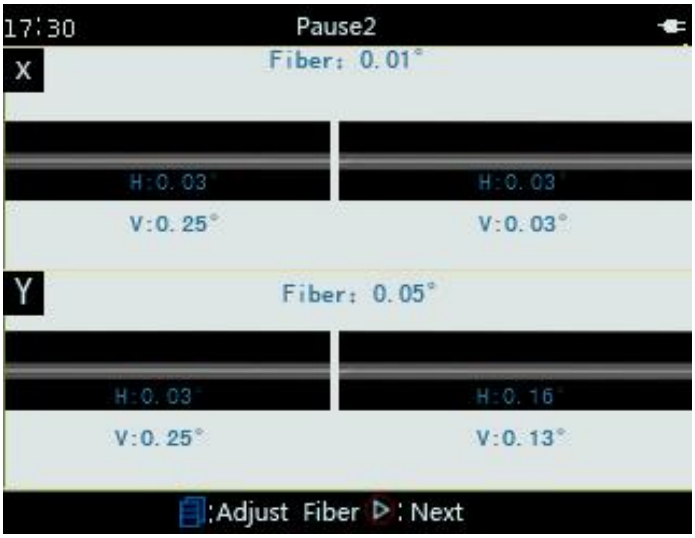
<3>In the "right fiber" operation window, press ▷ or ◁ button to move right feed motor of the X (Y) field selected forward or backward. Press △ or ▽ button to move the alignment motor of the Y -field selected upward or downward.

Comparison table of X (Y) field feed motor and alignment motor

X (Y) field feed motor	▷	◁
Left feed motor	Forward	Backward
Right feed motor	Backward	Forward
X (Y) field alignment motor	△	▽
X field alignment motor	Upward	Downward

Y field alignment motor	Upward	Downward

<4> At "Pause 1" status in the splicing process, 4 motors (feed, aligning) can be adjusted manually (step by step) by pressing button, so that the gap between the left fiber and right fiber can be (aligned) best. Press button,the machine goes from "Pause 1" to "Pause 2" and suspended.



<5> At the "Pause 2" status in the splicing process, 4 motors (feed, aligning) can be adjusted manually (step by step) by pressing buttons so that the left fiber and right fiber can be aligned best (gap). Press button. The fibers can be spliced by the arc of the fusion splicer.

<6> After splicing, the machine will automatically calculate "splice loss" and it is displayed on the screen.

- **When the left (right) motor is advanced by manual key to the limit position, the motor will stop running.The operator shall press manually the button to move the motor in the opposite direction.**

5. Inspection and maintenance

The following describes the key points for cleaning and maintenance inspection.

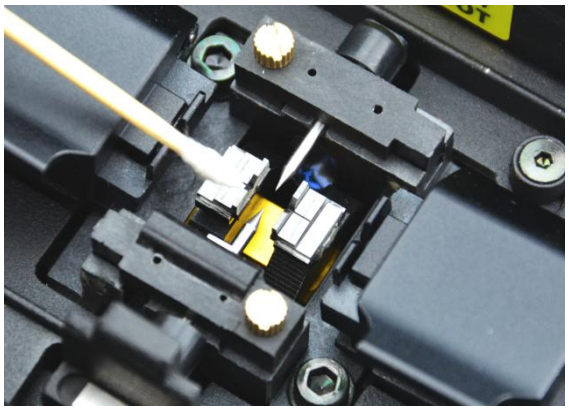
- For the operation in section 5.1 ~ 5.5, turn off the fusion splicer power.

5.1 Cleaning V-groove

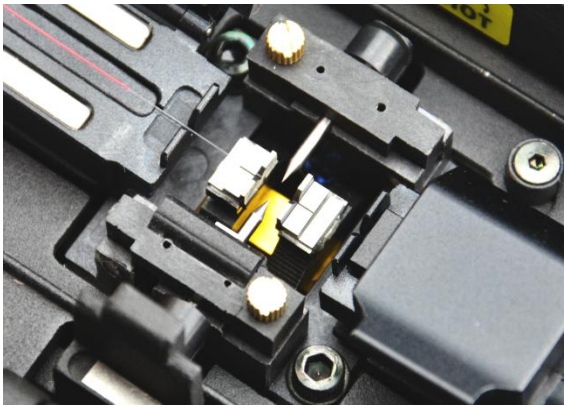
If the V-groove is contaminated, it can not grip properly the optical fiber and this will cause the splice loss too large. So in daily work, the V-groove should be checked and cleaned periodically or regularly.V-groove cleaning steps are as follows:

<1> Open the wind cover.

<2> Clean with a thin cotton swabs moistened with alcohol the bottom of V-groove, and wipe off with a dry cotton swabs the alcohol left in the V-groove.



<3> If the thin cotton swabs moistened with alcohol cannot eliminate the contaminant in the V-groove, the operator can use the tip of the optical fiber with the coating layer being stripped to remove the dirty from the V-groove, then repeat steps <2> .



- Be **careful not to touch the electrode tip.**
- **Do not use excessive force when cleaning V-groove,in case damaging V-groove wall.**

5.2 Cleaning fiber clamp

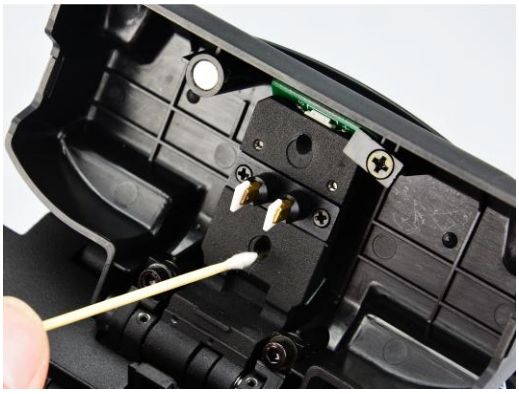
<1> If the fiber clamp is contaminated by dust, the fiber gripping may have problem. This will likely result in poor quality of the splice point. In routine working process, the fiber clamp should be checked and cleanedregularly.

<2> Cleaning fiber clamp according to following steps: Open the wind cover. Clean with a thin cotton swab moistened with alcohol the surface of fiber clamp, then wipe with a dry cotton swab the clamp.

5.3

Cleaning LED in light bracket

If two lads in the light bracket are dirty due to dust, the location of the optical fiber core will not be accurate due to less light transparent degree. This is bound to cause big splice loss. Clean the light according to the following steps: Remove dust from the surface first with ear syringe. If the effect is not good, clean the surface of the LED in the light bracket with fine cotton swabs dipped with alcohol(up and down two holes perpendicular to the optical fiber clamp). Wipe off residual alcohol on the light with dry cotton swabs as shown in the figure below.

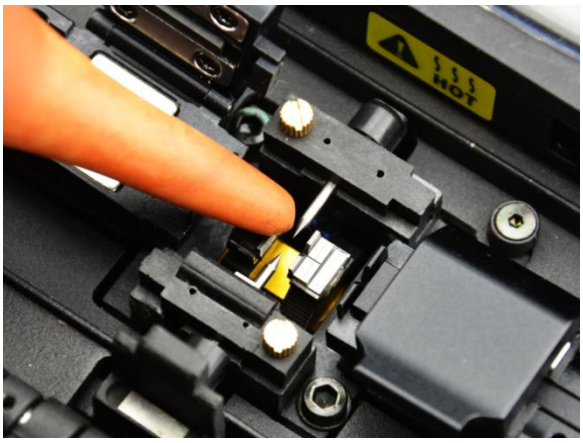


5.4 Cleaning objective lens

If the objective lens become dirty, the normal observation position of the optical fiber core may be affected, this will result in high splice loss or bad splicing. So the operator shall regularly clean two objective lenses, otherwise, the dust will be accumulated and eventually can not be removed.

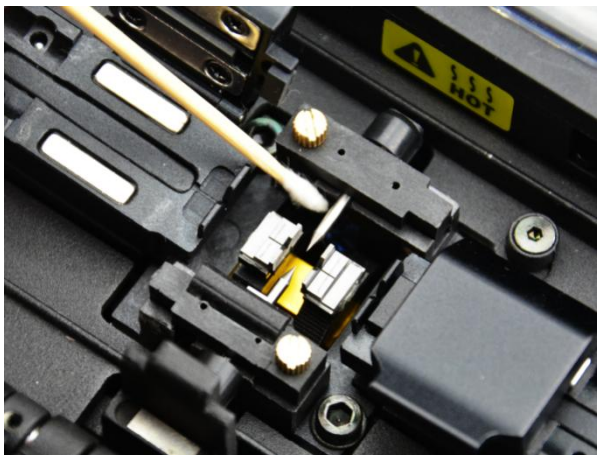
5.4.1 Routine Maintenance

In routine maintenance, the ear syringe may be used for blowing off the dust from the surface of the mirror and the objective lens of the fusion splicer.



5.4.2 Cleaning with anhydrous alcohol

The mirror and objective lens are dusty after a long time without routine maintenance, resulting in whitening and fuzzy black-clad of fiber image. Steps to clean the objective lens with anhydrous alcohol are as follows:



<1> Before cleaning the lens, turn off first the power of the fusion splicer.

<2> Roll specific lens paper into a stick,then fold and tear out, then clean the mirror, objective lens surface with the rough edge of the stick.

<3> When the lens paper cleaning is invalid and the objective lens surface is free of visible dust particles,try to use a thin cotton swab dipped in a little pure alcohol (99% and above) and wipe gently the lens surface. **It is recommended in principle not to use alcohol to clean the mirror surface.**

<4> Wipe the lens with a cotton swab from the middle of the lens and make a circular motion up to the edges of the lens. Then wipe with a clean dry swab the remaining alcohol. The objective lens surface should be clean and free of dirt.

<5> Turn on the power supply of the fusion splicer. Make sure the dust and streaks are not visible on the display. Press and transfer X / Y fields to check the surface condition of both objective lens. Do dust inspection.

★ **Incorrect use methods or undesirable chemical substances cleaning objective lens can cause optical fiber imaging fuzzy damage the equipment.**

● **When cleaning, be careful not to bump into or touch the electrode rod.**

5.5 Replacement of electrode

Electrodes will be worn-outafter long-term use, plus silicic oxide accumulates on the tip, it also requires regular cleaning. It is recommend to replace the electrode after 3000 times of arcs. If the machine continues in service without changing the electrode, it will increase splice loss and reduce the strength after fusion splicing.

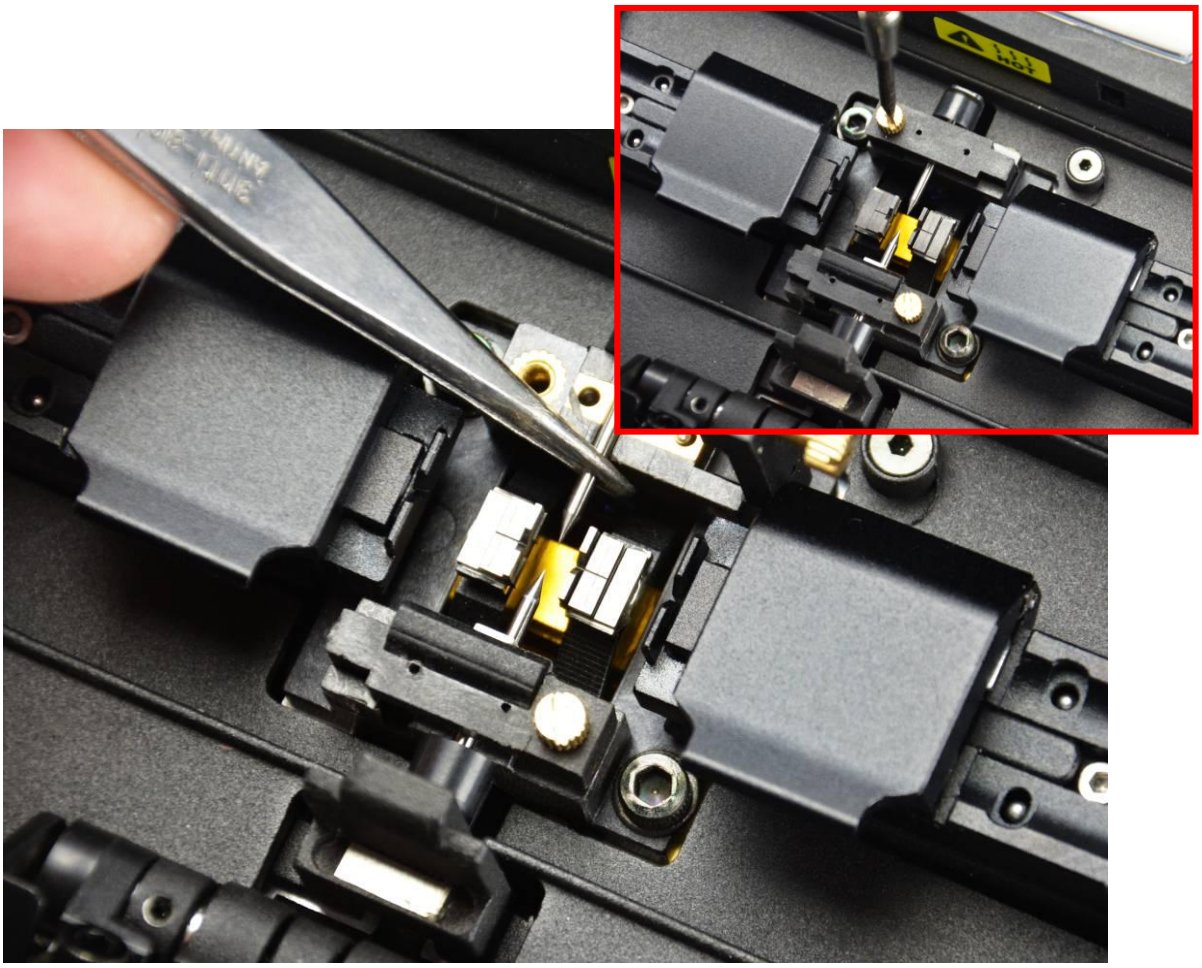
The steps replacing the electrode are as follows:

<1> Before replacing the electrode,turn off first the power of the fusion splicer.

<2> Remove the old electrode. Removal method is as follows:

a. Loosen the fixing screws on the electrode clamp.

b． Open axially the electrode clamp. Take out the electrode from the electrode holder.



<3> Clean the new electrode with tissue paper dipped in alcohol, then install the electrode to the original holder position.

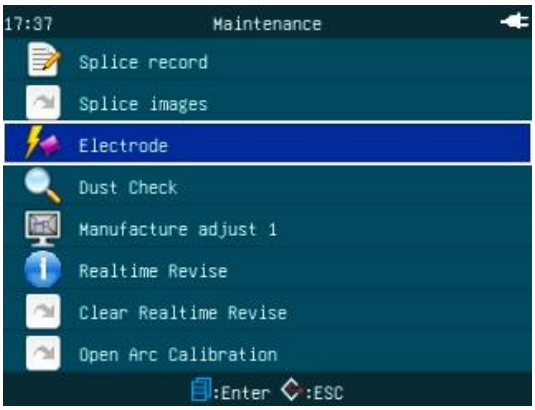
<4> Install the clamp on the electrode and tighten screws.

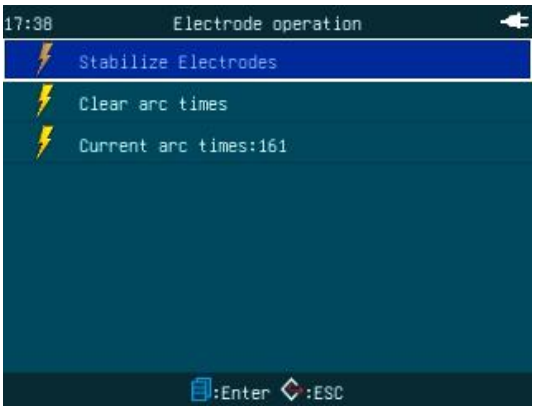
- **Do not tighten the screws with the force larger than finger's force.**

5.6 Stabilizing electrode

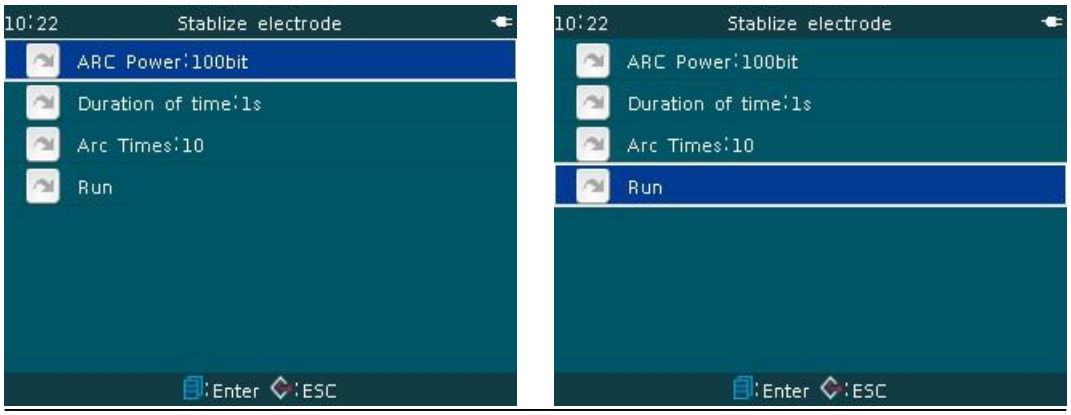
When replacing a new electrode or the external environment changes, electrode (tip) surface is attached with dirty. A direct result of the arc intensity is sometimes unstable, leading to more splice loss, especially when the fusion splicer moves from low altitudes to high altitudes. It takes some time to stabilize the electrode. In this case, stabilizing electrode will accelerate the process of stabilizing arc intensity. Steps are as follows

<1> In the "Maintenance" menu, move the cursor to "electrode" entry, press  button and enter "Operation electrode" lower level menu.Move the cursor to "stabilizing electrode" item.

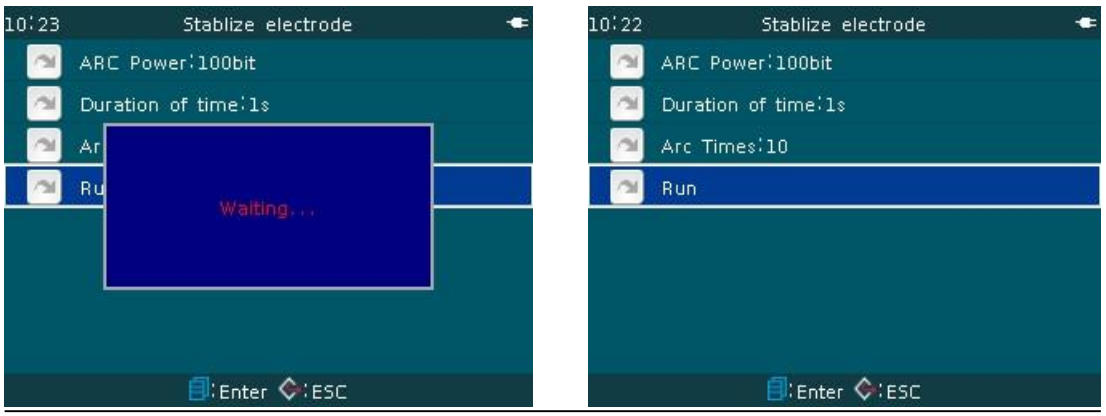




<2> Continue to press  button and enter "stabilizing electrode" operation window.Move down the cursor to "run" item.



<3> Press button. The fusion splicer starts 10 times of "stabilizing electrode" arcs.

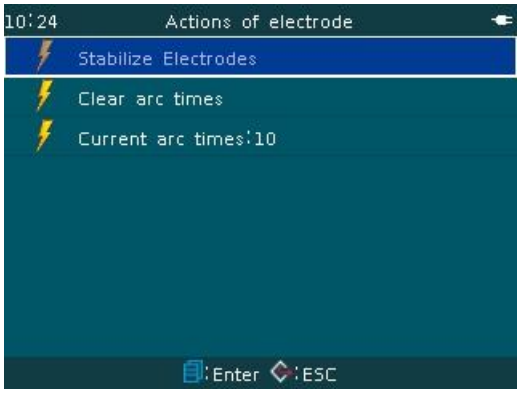


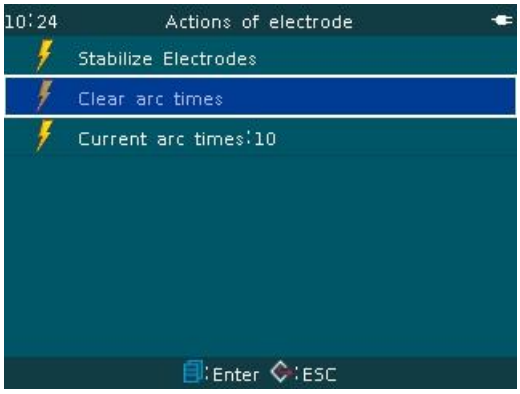
<4> Certainly, the operator can visually check arc stability in fiber splicing and confirm if "stabilizing electrode" operations are needed.

5.7 Clear arc times

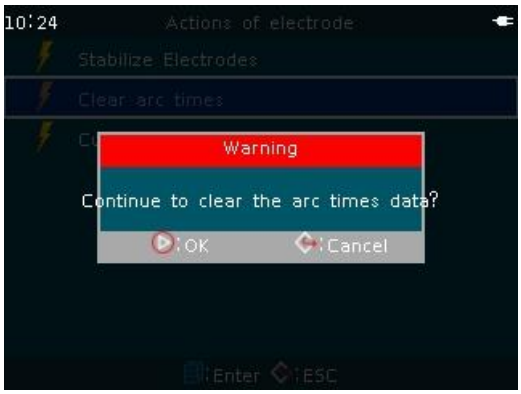
This function can reset the times of arcs.

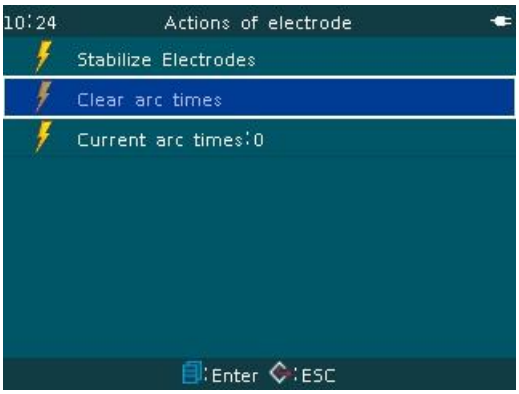
<1> In the "operation electrode" menu, move the cursor down to "clear arc times" item.





<2> Press button. "continue to clear arc times?" dialog box appears. Press button."Current arc record 75" is cleared and "current arc times" is set to 0.





5.8 Dust Check

The operator observes the optical fiber through the imaging system of the fusion splicer. The dust or dirt on the camera, the lens and mirror of the imaging system may affect the observation and cause bad splicing results.With the dust check function, the operator can check the dust and dirt on the optical fiber path and indicate their location.

5.8.1 This feature allows the user to check the dust or dirt on the optical path and determine whether they affect the detection on the optical fiber.

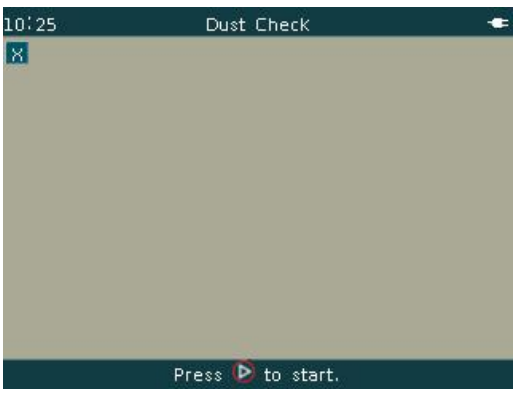
5.8.2 Operation steps

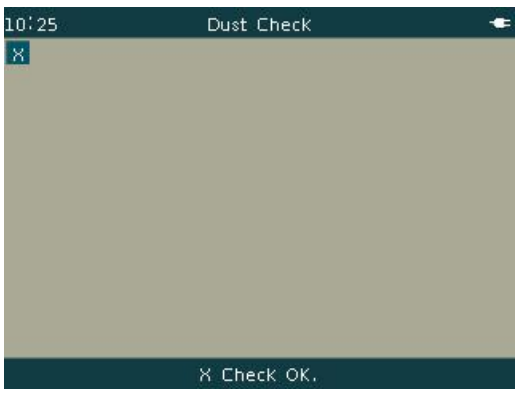
<1> Before starting the test, take out the optical fiber from the fusion splicer.

<2> Check visually if lens, mirror surface are free of foreign material.

<3> In the "Maintenance" menu, move the cursor to "dust check" and press button to enter "X dust check" operation window.

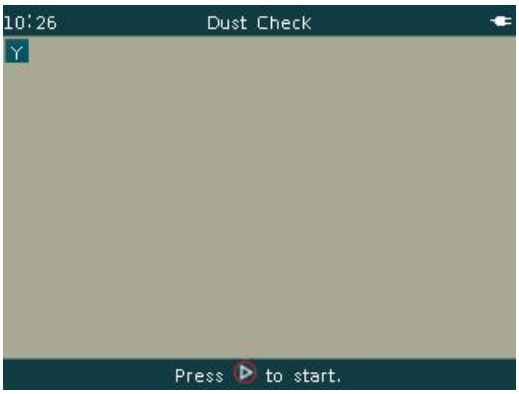
<4> Press button.The fusion splicer completes soon "X image check Ok". If there are any dust points, the position is shown on the screen.

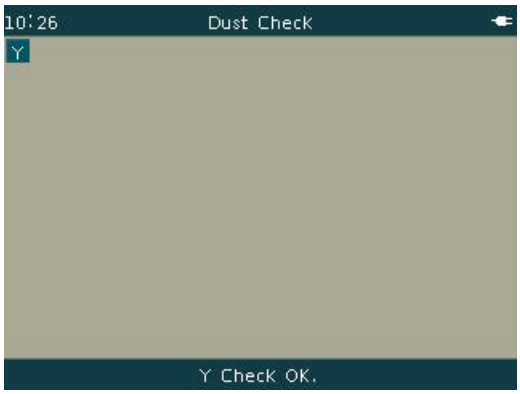




<5> Upon completion of X image dust check, press X/Y button. The screen switches to Y image. Continue to press button. The fusion splicer completes soon "Y image check Ok". If there any any dust points, the position is shown

on the screen.





<6> Upon completion of respective 2 image dust check and passing, press button in turn to return back to the fusion splicing window. The normal optical fiber splicing work can be done.

- **If the screen displays "image dirty" after the dust check,the operator shall clean the objective lens and mirror inside the wind cover. If after cleaning and doing "Dust check" again, but the dirt remains, it indicates that the dirt may go into the optical path. Please contact the manufacturer or dealer.**

5.9 Maintenance of cutter

5.9.1 Cleaning fiber cutter

<1> Keep clean the fiber clamp surface of the cutter. Do not touch oily liquid.

<2> Clean with a thin cotton swab dipped with alcohol the blade and pressing pad.

<3> After each use, it is to be noted that the rubber press pad shall be free of any residual broken fiber or other debris. The cutter after cleaning shall be put into a

special packing box (bag).

5.9.2 Adjustment of blade height

<1> Adjusting upwards the blade: The blade can not cut the fiber for a few successive times, or the fiber end face has very irregular, cutting mark or obvious cutting edge. It may be caused by insufficient height of the blade. Blade height adjustment sequence is as follows: Use a wrench to loosen the height locking screws on the cutter holder. Rotate the height adjusting screws in clockwise a little as required, then tighten gently the height locking screws.

<2> Adjusting downwards the blade: The fiber end face after cutting has always concave face, black spots, or angled etc. It may be caused by bladetoo high. Blade height adjustment sequence is as follows:

Use a wrench to loosen the height locking screws on the cutter holder. Rotate the height adjusting screws in counter clockwise a little as required, then tighten gently the height locking screws.

5.9.3 Changing blade position

After height adjustment, the cutter can not cut off the fiber still for a few successive times, or the fiber end face after cutting has very irregular cutting mark. It may be caused by unsharp blade at simple point. It is necessary to change the cutting position of the cutter blade. Hold the cutter blade with left hand. Loosen the blade locking screws with a hex wrench (1.5mm) with right hand. Rotate the blade to a new cutting point, then tighten the blade locking screw.

5.9.4 Replacement of blade

The average life of the blade is about 48,000 times of cutting To ensure the cutting

effect, it is recommend to change the blade in time.

<1> Loosen the blade locking screw with a hex wrench and remove the screw and washer on the blade.

<2> Put the cutter at 90°position. The blade faces upward. Open big press plate. Clamp carefully with tweezers on both sides of the blade. Lift gently the blade and put it on a proper place. Clean with a cotton swab dipped in alcohol the blade axis.

<3> Clamp with tweezers a new blade and hold the blade flat. Put the blade into the splicer from a position slightly above the blade axis. The blade hole is aligned with the axle. Rotate the blade with a cotton swab gently touching against the surface of the blade, so that the blade is rotated to 1:00 direction.

<4> Put the blade gasket on a corresponding position of the blade and screw up and tighten the blade locking screw.

5.9.5 ⚠ Precautions in cutter operation:

<1> Dismantling and oiling the machine may cause malfunction. It is absolutely not permitted.

<2> The cutter is a precision part. Beating and falling to the ground (impact) may damage the performance of the cutter, and will cause the personnel injured, so the operator shall be particularly careful in application.

<3> The blade mounted on the machine is very sharp. Do not touch it with hand (or other parts of the body) in case of injury.

<4>

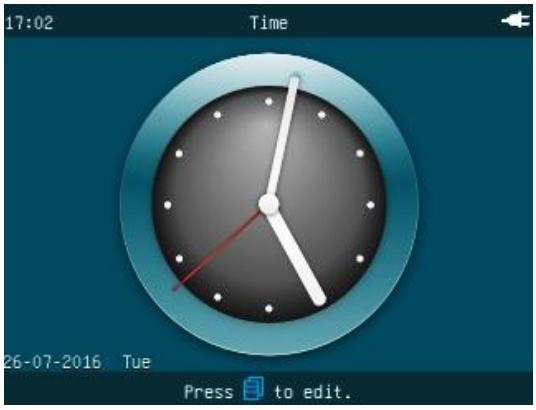
Fiber and fiber debris are tiny and have sharp tip. If piercing into the finger and getting into the eyes, they can cause injury. The operator shall be careful in operation. Fiber debris shall be put into a dedicated waste site separated from general waste.

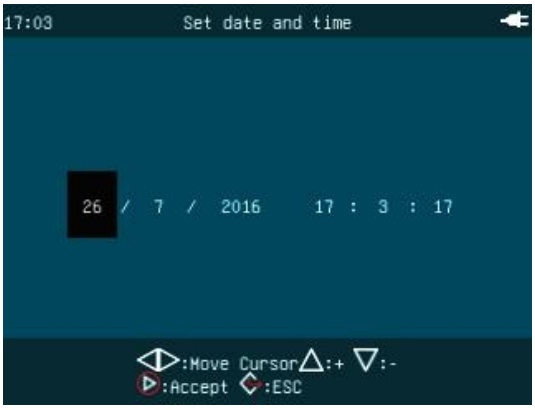
<5> If the cutter is not used, put it into a box and keep the box in a dry, dust-free place.

<6> If the machine fails or is abnormal, stop using it. Do not disassemble or modify it. Contact the customer service center of the factory.

5.10 Calendar setting

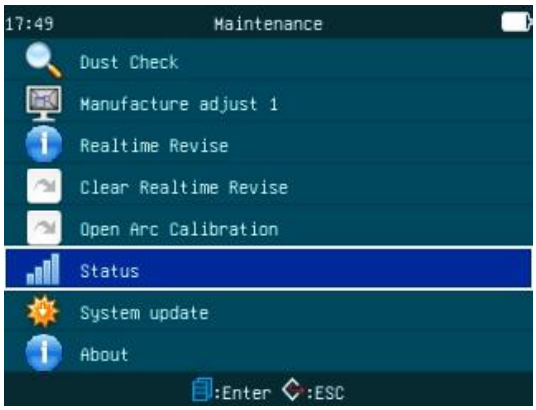
This function is used to set the calendar and time inside the fusion splicer. Operation steps: please refer to "3. 7. 1 time" of the manual.

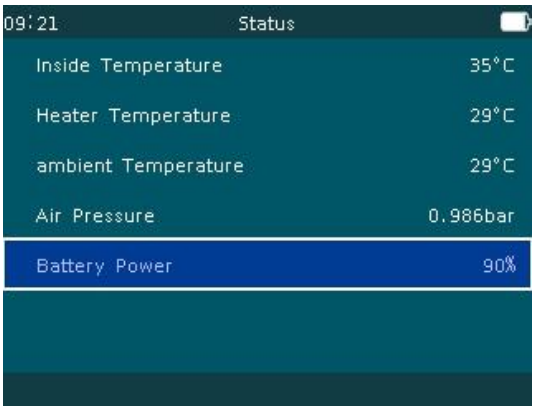




5.11 Heater / battery / environment

This feature not only provides users with information about the current operating environment, but also improves fusion splicing properties and provides software correction values. Operation steps: please refer to "3.6.9 status" of the manual.





5.12 Replacement of spare lithium batteries

Refer to "2.1.2 lithium power supply" of the manual. Replace the backup battery.

6. Problems and troubleshoot

6.1 Power supply

The splicer does not shut down after pressing button.

Press button until the keypad indicator light is turned from red to green and release the button then. The fusion splicer shuts down.

Full charged battery can not finish several times of splicing.

- If the fusion splicer power-saving function is turned off, power consumption will increase.
- As the battery discharges by chemical reaction, the temperature too low will lead to reduced capacity, in particular below zero.
- At high altitudes, arc current will increase. In this environment, the battery capacity will decrease rapidly.
- AC / DC adapter is not the model provided by our company, or the charging time is not enough.

LED (power module indicator) blinks during charging.

- Temperature is too high (above 50 degrees) or the battery is exposed in direct sunlight.
- Battery is faulty or has exceeded the service life. Insert a new battery. If LED is still blinking, please contact the manufacturer or distributor.
- AC / DC adapter is not the model provided by our company.

6.2 Fusion splicing operation

Splice loss value is unstable / high.

- Clean V-groove, optical fiber clamp, mirror, objective lensinside the wind cover. See [inspection and maintenance] (Chapter 5).
- Replace the electrode. See [Replacing electrode] (Section 5.5).
- If the fiber is bent, the bent portion of the optical fiber is placed upward.
- Splice loss is decided by the cleave angle, arc conditions and fiber cleaning.
- If finishing the operations above, splice loss is still too high or unstable, contact the manufacturer or agent. It is recommended for regular maintenance (once a year) to ensure good splicing quality.

Confirmingsplicing program

- See [splice mode] operation (Section 3.2)

Display is suddenly closed.

- When the fusion splicer is powered by the battery,the operator shall turn on the power-saving function.If the fusion splicer does not operate after a little time, the display will shut down automatically. Press any button to return to a normal

state. If changing the time setting, refer to [Power Save] (Section 3.7.5).

Change the cleave angle, splice loss, offset angle limit

- See [splice mode] operation (Section 3.2)

Error messages can be ignored.

- Enter [ignored display] in [splice options] menu (Section 3.5) and refer to the error messages allowed to be ignored.

Arc intensity and time can not be changed.

- In Auto mode or Calibrate mode,these parameters can not be changed.
- In the modes above,after executing the arc calibration, the splicer can get sufficient arc intensity.
- In Normal mode,arc intensity and time can be changed unless the operator locks them.

Showing cleave angle, fiber angle, fiber core/ clad offset

- For cleave angle,fiber angle, core / cladding offset settings, see [data display] in [splice options] (Section 3.5).

In the automatic mode, unsuitable splice mode is selected.

- Automatic mode can only apply to standard SM, DS, NZ, MM optical fibers.See [splice mode] operation (Section 3.2).

Splice loss estimation and actual value are inconsistent.

- Splice loss estimate is an internal calculated value of the fusion splicer,only for reference.
- Splicer optical components may need to be cleaned.

6.3 Heating operation

Heat shrink sleeve is not completely shrink.

- Prolong heat time or increase temperature. See [heater mode] (Section) 3.3).
- The reinforcing core of the heat shrink sleeve is not placed on the bottom. Optical fiber is not distorted. See [heater operation] (Section 4.7.3).

The heat-shrink sleeve after shrinking is stuck to the heating groove.

- Eliminate it with a cotton swab or other soft material.

Automatic heating function does not work.

- After the transparent window of the heater is closed, the right press plate of the heater can not effectively hold down the optical fiber (or fiber-optic breaks by pressing). See [heater operation] (Section 4.7.3).

Cancel heating operation

- Press  button one time.

6.4 High lever setting

"Select" and "Edit" in lock splice and and heater modes

- See [Menu Lock] (Section 3.7.6).

Appendix A: Warranty period and conditions

The warranty period of the fusion splicer is:

Optical fiber fusion splicer host:2 years; Fusion splicer display: 1 year;
Power adapter: 1 year; Lithium battery charger: 1 year;
Fusion splicer battery: 6 months.

● **If the following occurs, it is not within the scope of free warranty.**

★ The failure or damage caused by the careless use of the operator (Including product physical damage, moisture short-circuit etc.);

★ Product damage caused by the disasters (earthquake, fire, flood, lightning, typhoons, etc.) or force majeure;

★ The product failure or damage due to improper use, or improper installation, or caused by non- original battery and accessories or other external factors, such as voltage instability;

★ The user tears up "warranty void after tearing up the label" label on the enclosure of the fusion splicer, and disassemble and repair the machine without authorization;

★ The user tears up "warranty void after tearing up the label" label on the enclosure of the lithium battery;

★ Consumable parts (such as arc electrode, cutter blade, fusion splicer carrying case, etc.).

● **Exemption clauses**

For the use of non-original battery,battery charger, power adapter and so onnot provided by our company, the Company will not accept any liability on alllosses caused thereby.

★ **Warning**

The fusion splicer battery is a consumable item and has strict safeservice life requirements: The charge-discharges in normal use are less than 300 times and the extended use is strictly prohibited.

nance and repair Information required

(the following information shall be included in the machine)

<1> Full name, Company, Address, Phone number, Fax number and e-mail.

<2> Fusion splicer model and serial number.

<3> Problems and fault symptom encountered.

a) What time and under what circumstances the problems occur?

b) How is the current situation?

c) The character and image information of optical fiber on the display when the machine fails.

<4> List of parts in the machine.

Appendix B: Contact US

If you have questions or suggestion about the product,please contact us for help:

Shenzhen Skyshl Technology Co.,LTD

Address: C-211,Qixing Industrial Area,LongTian Road,PingShan Direct,Shenzhen City,Guangdong,China.

WhatsAPP/Wechat:+086-18923700205

Sales email: sales1@skyshl.net After Sales email:af@skyshl.net

Website:www.skyshl.net

★ **The company's product performance and properties are improving and subject to change without notice.**

★ **If the pictures in this manual are inconsistent, the product is final.**